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OWN MAGAZINE . . .

CHEMICAL PROCESSING

AUGUST 1961

Here's How EVOP Can Cut Your Costs

Technique permits constant improvement in process, saving one company $25,000/yr 23

CPI Can Expect New Breed of ChE

Utilizing skills of this engineering-scientist requires understanding from operating managers 25

CORROSION

Full-time Foe Being Fought On Part-time Basis

. . . exclusive CP survey leads off 38-page Eighth Annual Corrosion Control Feature. See index on page 39

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over the editor's shoulder

Story of a story

"Rust in Peace" — the article appearing on page 40 of this issue — has an interesting history. The idea of conducting a survey about the management side of corrosion control seemed like a good thing right from the start.

We were encouraged to proceed with the project by many experts in the field, including two of the foremost corrosion engineers in the country, Mr. W. A. Szymanski of Hooker Chemical, and Dr. L. W. Gleekman of Wyandotte Chemicals Corporation. These men assured us that such a survey would be of tremendous interest to the chemical industry.

The project shifted into high gear in March of this year. The gathering, screening and interpretation of data took about four months of intensive work on the part of our editorial staff. When completed, we had specific information from 15 major chemical companies — representing over 25 plants in the U. S.

Frankly, the finding that many firms have been neglecting their corrosion control programs came as no surprise to us. CP editors have had ample evidence of this for quite some time. We have seen the situation first-hand, in the many plants that we are constantly visiting.

Let's hope that this article stirs management thinking about making improvements in its corrosion control programs. Technical advancements are rapidly being made in this field — it's just a matter of adapting these techniques more thoroughly in chemical plants. With billions of dollars being lost each year because of corrosion, management cannot afford to do otherwise!

Ted F. McElwee
Associate Editor

THAT'S INTERESTING

Insecticide thins, too

An insecticide, 1-naphthyl N-methylcarbamate, can double as effective and economical thinner of apple blossoms, USDA researchers have discovered.

In 100 tests, it proved effective in thinning five major varieties —hard-to-thin Golden Delicious and Jonathan, and easily thinned Delicious, Winesap, and Granny Smith.

Muscles by radio

Engineers and physicians are collaborating on a project at Case Institute of Technology to develop tiny wireless unit which may be implanted in a muscle and ultimately be used to activate paralyzed. muscle. Control would be provided by external radio source. Electricity generated by muscle would power unit.

For more information on product at right, specify 5117 see information request blank opposite last page.

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2-NP ($CH_3CHNO_2CH_3$) is a member of the extraordinarily versatile CSC Nitroparaffin family. Its most outstanding characteristic is its unique solvent property which permits the use of larger proportions of low cost alcohols and aromatics in solubilizing a wide variety of coating materials, dyes, organic chemicals, fats, and oils. This unique property is of special interest in the formulation of vinyl and epoxy coatings.

Solvent for Vinyls

With the introduction of 2-NP—for the first time—formulators of vinyl chloride-acetate copolymers were able to obtain coatings with 1) lower viscosity and/or higher solids, 2) medium evaporation rate with better flow, 3) improved solvent release resulting in reduced drying time, and 4) mild odor. In addition to these advantages, the ability of nitrated solvents to displace water results in coatings with better adhesion to hydrophilic surfaces and better weathering properties due to improved dispersion. 2-NP's high flash point and low volatility provide added safety factors.

Research and field experience in the packaging industry have shown that the high solids content of 2-NP-formulated vinyls offers important advantages in the high-speed coating of food and beverage containers. 2-NP also proves useful in vinyl ink applications since it does not attack gelatin or most rubber rolls but still provides outstanding adhesion or "bite" to many plastics.

Low Viscosity and/or High Solids Content

2-NP can be formulated to give vinyl solutions of higher solids content and/or lower viscosity than any other medium evaporating solvent. In addition, 2-NP solutions have good stability and show no tendency to gel.

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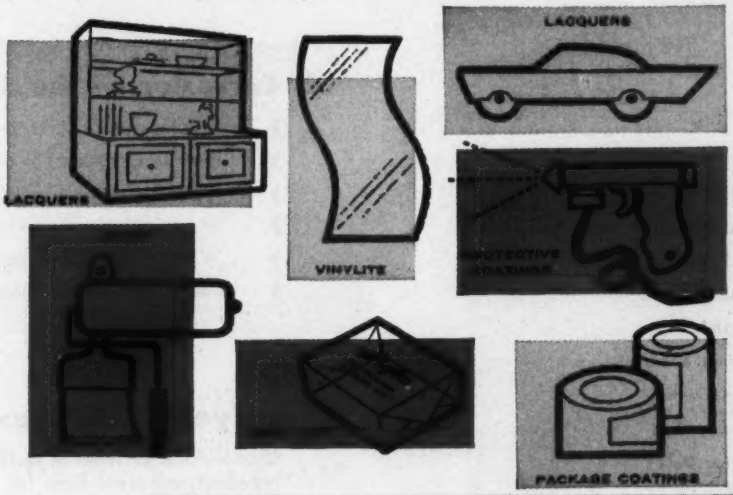
2-NP is compatible with amine catalyzed systems (with the exception of ethylene diamine) and systems employing urea-formaldehyde, polyamides, or phenolic cross linking agents.

The ability of nitrated solvents to wet pigments and hydrophilic surfaces, as previously mentioned in the section entitled *Solvents for Vinyls,* also applies to epoxies as well as other vehicles used by the coating industry.

Want more information on 2-NP for Vinyls and Epoxies?

If you would like to have test samples and complete technical data on 2-Nitropropane for your vinyl and epoxy formulations, fill in and mail the coupon below.



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CHEMICAL PROCESSING

HIGHLIGHTS

AUGUST 1961

VOLUME 24 • NUMBER 8

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Makes process produce not only product but data; saves one firm $25,000/yr

25 Education revolution spawns new breed of ChE

Utilizing skills of this engineering-scientist requires understanding, adjustments from operating managers

30 Filled-Teflon gaskets shut off leakage

Cope with temperatures to −322°F, quivering surges of pressure in missile service

38 Corrosion — the challenge and how it is being met

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- How to get most life out of glass-lined equipment
- Choosing alloys for 1200°F + corrosive applications
- Impregnated-wood filter presses pay out every year
- Water pipe 'watchdog' nips corrosion costs
- Things you should know about maintenance coatings

77 Polyethylene latex—new base for waxes, polishes

Uses loom as softener in textiles and as water-repellent, adherent films for paper

THIS MONTH'S COVER

. . . shows a corroded bubble cap (about the size of a tennis ball) as symbolic of the damage suffered by chemical plants because of corrosion. This foe, with its ravenous appetite, chews away at the vitals of American industry to the tune of $6 billion annually. You'll find techniques and tips on how better to control corrosion in the 38-page section beginning on page 39. (Credit for the bubble cap photograph goes to American Cyanamid Company.)

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THAT'S INTERESTING

Sweetening x-rays

Sweetening photographic developer with a pinch of sugar or glucose extends the useful range of films for radiation recording, Kodak scientists have discovered.

When film has absorbed a certain amount of radiation, it reaches a maximum density. Sweetening the developer extends this range.

About 7 oz of glucose qt is recommended.

Sea hunt for atoms

An ultra-sensitive radiation measuring device, called DUNC, is being used by the Navy to analyze the sea's naturally occurring radioactive sources. This device is so sensitive that it can detect one atom of radium in a billion molecules of water.

For more information on product at right, specify 5118 see information request blank opposite last page.

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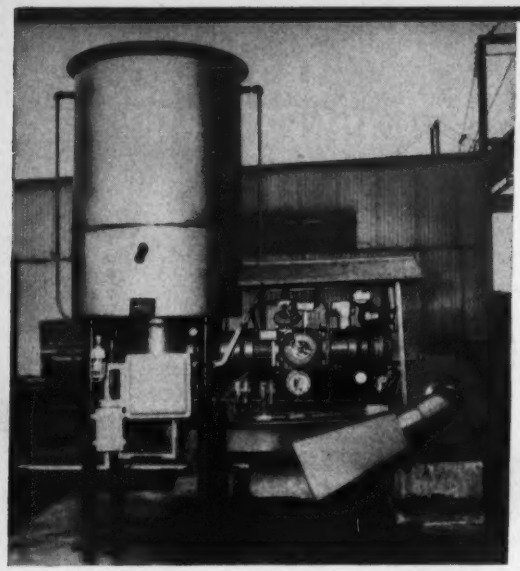

Packaged THERMAL Waste Burner System installed at The Trubek Laboratories Inc. is used to burn waste solvents and mixed aromatics. It provides automatic and complete, odor-free incineration.

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AUGUST 1961
VOLUME 24 • NUMBER 8

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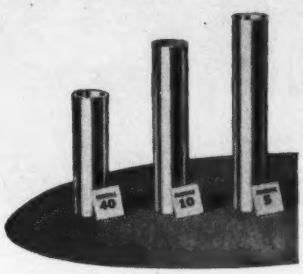
REAL ECONOMY IN PROCESS PIPING IS A MATTER OF SPECIFICATIONS—AND SPEEDLINE FITTINGS!

Make the most of both. First, be sure to check ASA B31.3 for up-to-date pressure-temperature data on critical process applications. This most recent issue of the Code for Pressure Piping certifies the use of light-wall pipe and fittings to a degree not recognized by outdated specifications.



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CHEM-TRENDS / Our Growing Industry

Allied starts up polyether plant and becomes first to supply all major urethane components

WITH PLACING on stream of a 20-million-lb/yr polyether plant at Baton Rouge, La., providing the occasion, **Allied Chemical** took time out to explain why it is betting $28 million in research and plant facilities on urethanes.

Start-up of the polyether plant enabled Allied to lay claim to being the first U.S. company to supply all major components for the burgeoning urethane industry. Five Allied divisions are already involved in the making and/or marketing of urethane chemicals and products.

Its **Barrett Division** is pushing construction applications, while **Solvay Process Division** is making the polyethers which will be marketed by **National Aniline** along with its diisocyanates. **Plastics Division** produces polyesters and **General Chemical** manufactures fluorocarbon blowing agents.

By 1965, urethane markets, as anticipated by Allied, will be as follows: rigid urethane foam, $110-to-$120 million (110 million lb); flexible urethane foam, $183 million (200 million lb); spandex urethane elastomeric fibers, 10-to-12 million lb, plus new markets; urethane finishes, $90 million (11 million gal).

To serve western market, Allied will build 15-million lb/yr isocyanate plant, expandable to 25 million lb/yr. Several sites are being considered. In another field, Allied's **Nitrogen Division** expects to double its nitrogen tetroxide capacity next month when facilities are completed at Hopewell, Va.

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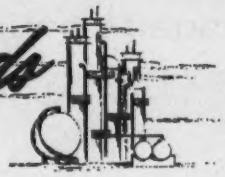
Chem-trends



Sees more active federal role in air-pollution control

More activity in local communities with regard to pollution is forecast for the U.S. Department of Health, Education & Welfare. At the recent annual meeting of the Air Pollution Control Association, Under Secretary Ivan A. Nestingen said, "The current air pollution law gives the Federal program the role of conducting research, training, and technical assistance and reserves to the States and local communities responsibility for control . . . I believe this is a sound approach to the problem but . . . we are clearly not doing anywhere near enough about the problem . . . in most areas of the country.

It is a truism — but a disturbing one — that the problem will only get worse . . . unless efforts on both the local front and the national front are greatly accelerated.

"The time has clearly come for the Federal Government to take a much more active role.

"The legislative proposal we are working on . . . is intended to provide more Federal assistance to States and localities . . . this would include financial stimulation and vigorous Federal leadership to help communities . . ."

More recently, it was announced that the greater New York metropolitan area will have a Federal study of water pollution. It is also proposed that smog warnings and a "community education effort" be received from the area's regional council. ■

Refiners big in math techniques for venture-dynamics tests

Twenty of the 28 oil companies representing 80% of the industry's volume have reported to IBM they are using data-processing equipment for the application of mathematical techniques in testing the dynamics of business. But lack of trained people for such work was said to be retarding progress. Asked if existing organizational structures are being challenged by the use of data-processing equipment, the answer was "overwhelmingly yes." Survey results were reported to the American Petroleum Institute meeting by IBM v-p T. V. Learson.

In another area, control for a steel furnace will be the next installation for a TRW computer. Unit to be so controlled is the world's largest basic oxygen unit of Great Lakes Steel Co. scheduled for '62. ■

Education — Team surveying Russian technical education for the Engineers Joint Council has issued a 100-page report stressing the quality and volume of USSR education. Among observations: "While the young Russian engineer probably has a better theoretical background when he starts his career than does our young engineer, his opportunity to develop creativity is far less, for the senior engineers with whom he is in contact devote much more of their time to studying to catch up with our designs than they do in creating new designs." The author goes on to caution: ". . . there seems no reason why Soviet engineers cannot become as creative as ours."

In other sections: "The new tendency in engineering education is to bring teaching nearer to production . . . (but) noticeably lacking is management-development training as widely practiced in U.S. ■

Processes — Keratinase enzyme as a dehairing agent may revolutionize traditional methods of leather tanning, according to Rutgers University. It decomposes hair at roots, permitting recovery and processing. Hide is unaffected. Enzyme is from *streptomyces fradiae* . . . Diamonds may now be produced by exploding downward-directed charges over graphite floating on water, according to Stanford Research Institute.

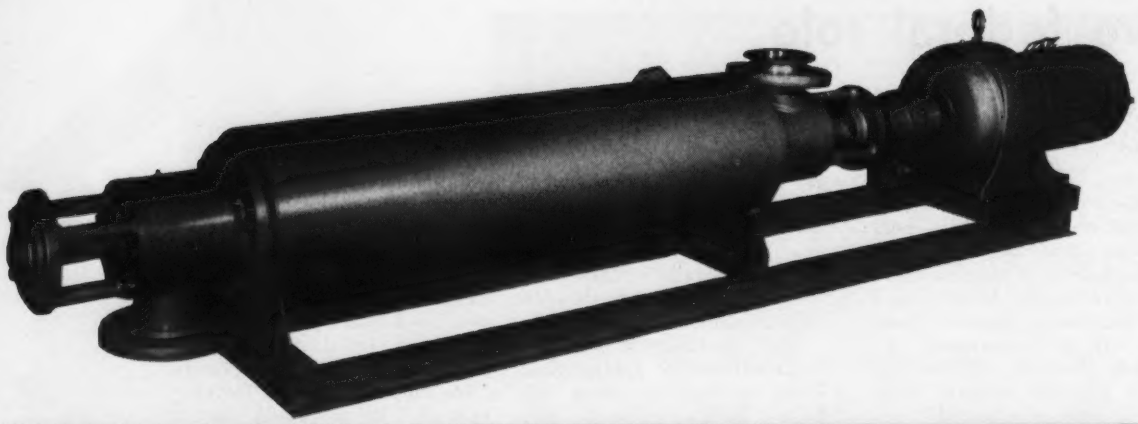
Equipment — Government guaranteeing industry against risks of investing in underdeveloped countries would entail protection of investing companies even against their own bad management. This was part of the Senatorial protest against the proposed "Act for International Development," which would cover up to 75% of the private investment. The hearing was conducted recently before a meeting of the Senate Foreign Relations Committee in Washington.

Materials — Powders will soon be propelled by aerosols . . . Second largest bromine source has been brought on stream at El Dorado, Ark. . . . Biggest solid rocket motor ever fired, eight by 30 ft and weighing 55 tons, was touched off by Aerojet at Sacramento, Calif. . . . Shell Oil reports it's now second largest in benzene.

Personnel — Biggest bottleneck in weather-modification programs is skilled manpower, says NSF . . . Olin-Mathieson recently gave its new college-recruit crop their last brush with brass for a while, as top management hosted during orientation program, explained company practices and philosophies. Next step: To work!

Information — According to Hughes Aircraft's "Vectors," it would take 8000 big computers to replace present card catalog of Library of Congress . . . Also, all of U.S. libraries combined do not receive one copy of each significant scientific publication produced in the world.

PROFITS CAN BE INCREASED



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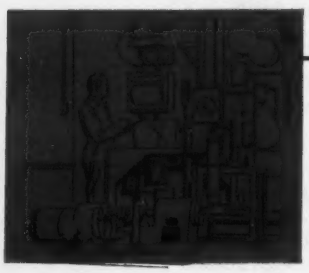

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VOTATOR—Reg. U. S. Pat. Off.

Check 5122 opposite last page.

OUR GROWING INDUSTRY

From page 8

AviSun Corporation, jointly-owned by **American Viscose Corporation** and **Sun Oil Company,** expects to become the world's largest polypropylene producer in September when its 100-million-lb/yr plant goes on stream at New Castle, Del. AviSun's Port Reading, N.J., plant now produces 25 million lb/yr.

Southern Nitrogen Company, Inc., has earmarked $5 million to expand capacity to meet growing demand in southeast. The Savannah Works' capacity for anhydrous ammonia will be boosted from 100,000 to 150,000 ton/yr. Nitric acid and ammonium nitrate capacity at Savannah is currently being expanded at $1.3 million cost.

Contracts for construction of much of its major complex of petrochemical plants along the Houston Ship Channel have been let by **Tenneco Chemical Company, Tennessee Gas Transmission Company** subsidiary. Awards include: **M. W. Kellogg Company,** 100-million-lb/yr acetylene plant; **Bechtel Corporation,** off-site facilities; **Hydrocarbon Research, Inc.,** to supply oxygen from $6½-million plant it will build on Tenneco property. Still to be let are contracts for 200-million-lb/yr vinyl chloride monomer plant, and three plants to produce vinyl acetate monomer, ammonia and methanol, respectively.

Borden Chemical Company awarded **United Engineers & Constructors, Inc.** job of constructing a 25-million-gal/yr methanol plant and 50-million-lb/yr vinyl acetate monomer plant on site adjacent to Geismar, La., site of **Monochem, Inc.,** joint venture of Borden and U.S. Rubber Co. Monochem will produce 80 million lb/yr of acetylene and 150 million lb/yr of vinyl chloride. **Vulcan-Cincinnati, Inc.** will engineer the methanol process. Total cost of methanol and vinyl acetate monomer plants, to be completed by mid-1962, will be $15 million.

Morton Chemical, under long-term contract, will build

its first anhydrous hydrogen chloride plant to supply the Monochem complex.

Arkansas Chemicals, Inc. has brought on stream its 30-million-lb/yr bromine facility at El Dorado, Ark. Output goes to Arkansas' parent companies, **Houston Chemical Corporation** and **Great Lakes Chemical Corporation.**

Another firm expanding its anhydrous ammonia capacity is **American Cyanamid Company** which is spending $3 million to increase by 40% the capacity of its Fortier plant near New Orleans, La. Completion is due late next yr.

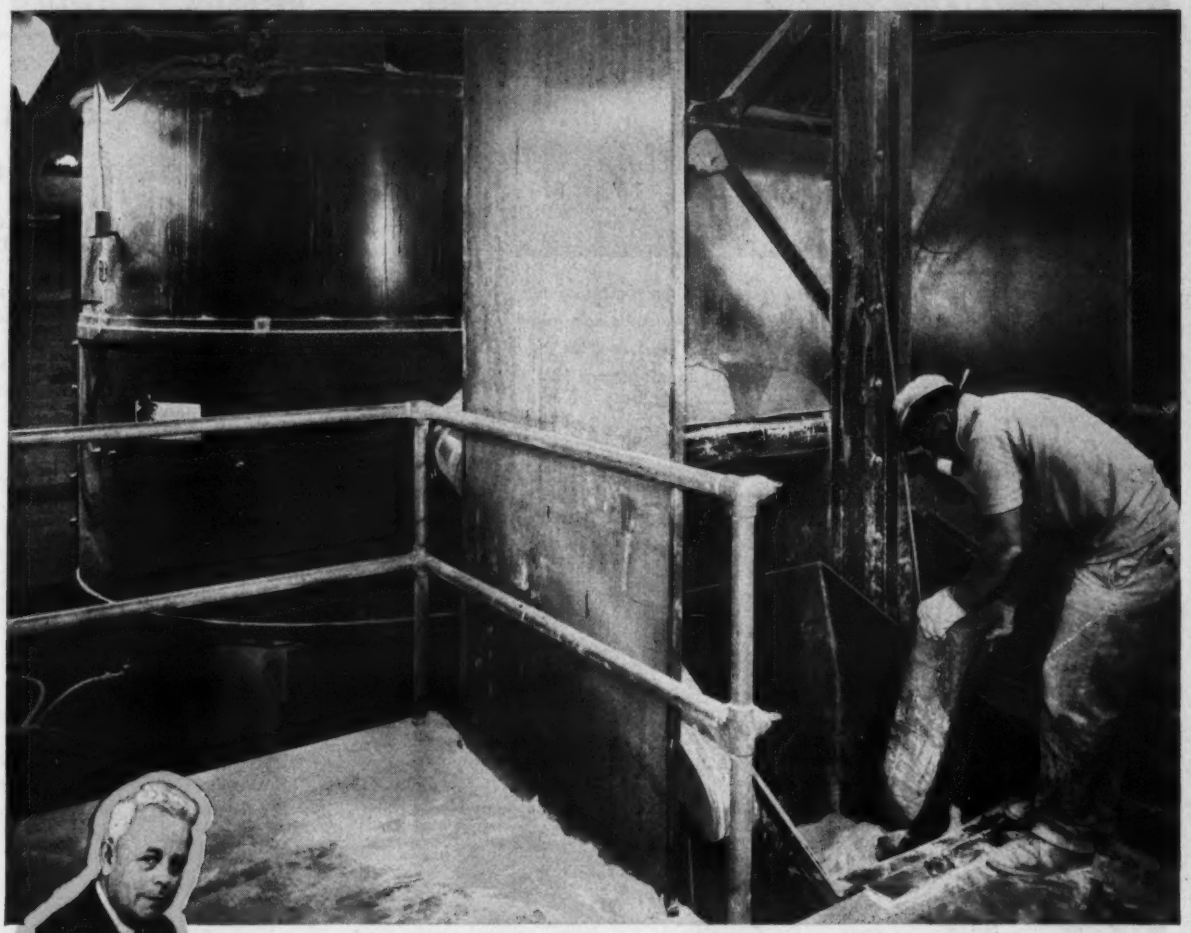
Scientific Design Company, Inc. will build an adipic acid plant for **Rohm & Haas Company** at Louisville, Ky. Completion is due next summer.

Introducing a high-analysis fertilizer, dubbed Mr. Greeen, **Spencer Chemical Company** announced plans to build a 50,000-ton/yr plant at its Jayhawk Works near Pittsburg, Kas. Spencer expects to have facility on stream in time for fertilizer season next yr.

Pennsalt Chemicals is spending $2 million to bolster its capability to supply ethylamines, isopropylamines and butylamines. Project, which will nearly double the capacity of its Wyandotte, Mich., alkyl amines unit, is to be completed early next yr.

Mergers were completed last month by **Chas. Pfizer & Co., Inc.,** which acquired **Paul-Lewis Laboratories, Inc.,** and **National Distillers and Chemical Corporation** which absorbed **Bridgeport Brass Company.** Proposed merger of **Diamond Alkali** and **Chemical Process** set off stock battle when **Commercial Solvents Corporation,** rejected suiter and substantial stockholder, tried to undercut marriage by bolstering its stock holdings in Chemical Process. Diamond countered with similar offer. Outcome will be decided in August when Chemical Process stockholders vote on merger. ■

MIX-MULLER® means Controlled Dispersion



"This Mix-Muller helps us produce better tile in less time."

. . . John C. Elder, Factory Manager, Robertson Manufacturing Company, Morrisville, Pennsylvania

In October 1960, the Robertson Manufacturing Company, a large eastern tile manufacturer, replaced their continuous filter system with a dry mix system using a Model 3F Simpson Mix-Muller. In December, Mr. John Elder, Factory Manager, had these comments to make about the new installation:

"Incomparably" better moisture control

"The Mix-Muller system allows us to maintain moisture variation to within plus or minus .1%. This allows a better, cleaner die fill which has increased our press efficiency and has reduced pressing and firing rejects. Better moisture control has also permitted us to utilize the faster and more economical 'one-fire' method of operation."

Better utilization of manpower

"The old system operated seven days a week on a 3-shift basis. With the Mix-Muller, we are able to obtain the same production on a normal five day a week, 1½-shift work schedule . . . releasing manpower for other jobs."

Realize substantial space savings

"The Mix-Muller system occupies only ½ as much production space as the previous wet system. This releases floor space—which we intend to use for pneumatic handling equipment to charge the mixer."

In Summary . . .

"The installation will pay for itself in reduced processing costs and increased production—notwithstanding the obvious benefits of vastly superior quality control."

If *you* mix dry or wetted solids, can you *afford* not to investigate how employment of *controlled dispersion* in a Simpson Mix-Muller can help you to attain (and we quote) *"vastly superior quality control . . . increased productive capacity . . . at less labor cost."*

See your National agent or write for the *Handbook on Mulling.*

P-261

SIMPSON MIX-MULLER® DIVISION
National Engineering Company
640 Machinery Hall Bldg. • Chicago, Illinois

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VICTAULIC
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Let the Victaulic Method save you money on piping costs. Whatever piping material you choose, Victaulic can join it and provide fittings. You save in material cost, in installation time, and in reduced piping maintenance cost.

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Check 5124 opposite last page.

Spotlight On People

McCoy becomes DuPont v.p., joins board, executive body

Charles B. McCoy, who started with DuPont 29 years ago as a cellophane operator, this month was promoted to vice president, director and member of the executive committee.

He succeeds **Robert L. Richards,** who retired as vice president and committee member but continues on the board which now has a membership of 30.

Succeeding McCoy as general manager of the company's Explosives Department is **Dr. B. H. Mackey,** formerly assistant general manager.

Arthur Hanisch, founder of The Stuart Company, has been elected vice president and director of Atlas Chemical Industries, Inc. Stuart, an ethical pharmaceuticals manufacturer, as a result of a recent merger is now the Stuart Company Division of Atlas.

Advanced from vice president, controller and chief financial officer of the Liquid Carbonic Division of General Dynamics Corporation is **John A. Edwards,** newly-named executive vice president. He is succeeded as controller by **William A. Runge.**

George L. Fearnley Jr., is now manager of The Kordite Company's new plastics manufacturing facilities in Tyler, Texas. He is succeeded as plant manager in Macedon, N.Y., by Melvin S. Cagen.

Witco Chemical Company, Inc., has appointed **Norman P. Ottley** as general purchasing agent for raw materials and fuels for all Witco divisions, including Sonneborn Chemical and Refining Corporation and Ultra Chemical Works, Inc.

Clinton J. Allen Jr., this month became administrative assistant to **Robert B. Semple,** president of Wyandotte Chemicals Corporation. He had been quality control manager.

Dr. Howard Steinberg has moved up from associate director of chemical research to director of chemical research for United States Borax Research Corporation, subsidiary of United States Borax & Chemical Corporation.

H. E. Hughes, manager of Shell Chemical Company's polyisoprene rubber plant currently under construction near Marietta, Ohio, has been named manufacturing manager of the synthetic rubber division. **G. A. White,** superintendent of operations for the Marietta plant, succeeds Hughes.

Francis J. Clancy has been appointed assistant secretary of DuBois Chemicals, Inc., but will continue to serve as manager of the company's Los Angeles plant.

Adding the responsibilities of personnel manager for the Marcus Hook, Pa., plant of American Viscose Corporation to his present duties as manufacturing superintendent is **Albert G. Ruff Jr.**

Shifted from production manager to general plant manager of the Kankakee Division of American-Marietta Company is **Vincent D. Jones.**

R. Carl Evans, has been promoted from director of marketing for Monsanto Chemical Company's Plastics Division to associate director of the corporation's Purchasing & Traffic Department.

Assuming new duties at American Viscose Corporation are **Dr. Orlando A. Battista,** named manager of Corporate Applied Research; and **Dr. Mamerto M. Cruz Jr.,** appointed head of the Avicel pilot plant operations. Dr. Bat-

tista helped invent Avicel.

Dr. George F. Rugar, formerly manager of applications research for Diamond Alkali Company, is now Washington representative with the responsibility of developing new business opportunities for Diamond with federal agencies.

Vernon W. Long succeeds **Edmund B. Gavin,** retiring after 43 years, as superintendent of the Atlanta, Georgia, works of Allied Chemical's General Chemical Division.

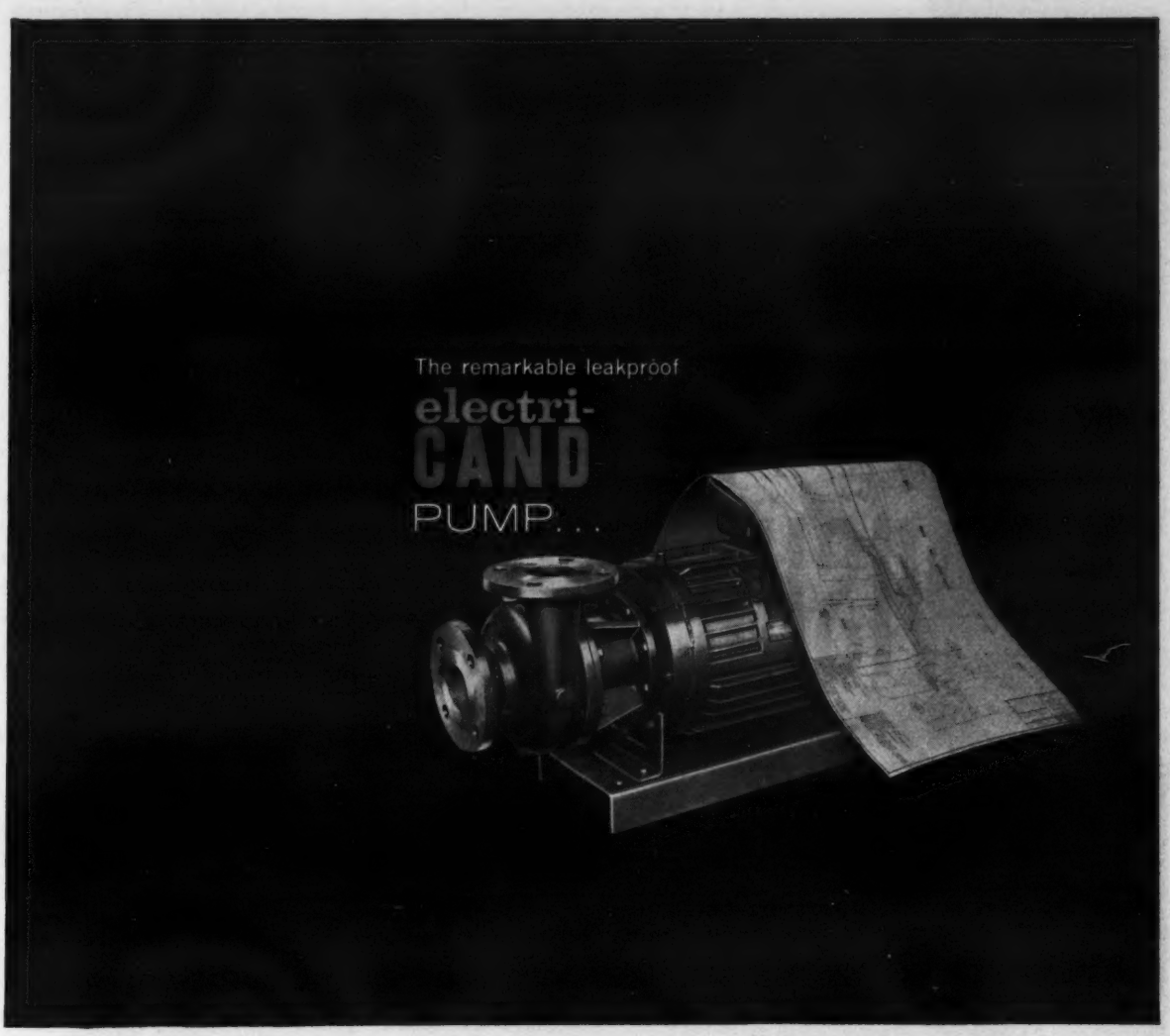
Andrew J. McNeill has been appointed divisional purchasing agent for Naugatuck Chemical Division, United States Rubber Co. He has been acting agent since July, 1960.

Ernest T. Handley, recently named managing director of research, Firestone Tire & Rubber Company, has assumed the duties of **Dr. F. W. Stavely,** who has retired as director of research. Dr. Stavely, directed the discovery of Firestone's stereospecific synthetic rubbers.

Herbert J. Siegel and **James J. Rochlis** have been elected chairman and president, respectively, of Baldwin-Montrose Chemical Company, Inc., recently formed by merger. Baldwin-Montrose operates the Baldwin Rubber Company and Montrose Chemical Company as divisions. It also controls as subsidiaries, Mono-Sol Corporation and General Artists Corporation.

Key executives named for California Chemical Company's Ortho Division plant food operations, now under construction at Ft. Madison, Iowa, include: **William McKinlay Miller,** plant manager; and **James E. Spaulding,** chief plant engineer. **Robert W. Garrett** has been appointed assistant to the president of California Chemical Company, Ortho Division.

Russell Edmond has joined Resisto Chemical, Inc., as manager of engineering and design. ■



To give more value, pumps and motors are designed together . . .

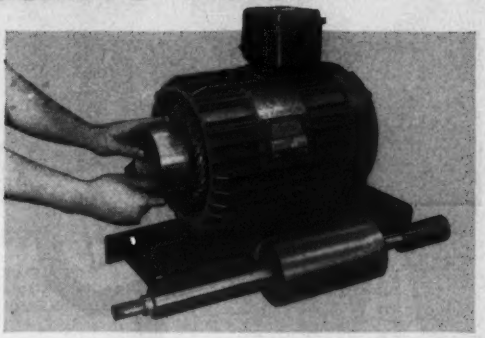
built under the same roof

Specify satisfaction . . . specify leakproof *Electri-Cand* pumps to safely handle "unpumpable" liquids. They're products of Allis-Chalmers combined skill in building pumps *and* motors. A-C designs both major components in integral horsepower sizes to work well together . . . carefully integrates them for absolute leakproof performance, for maximum reliability.

Electri-Cand pumps handle practically *any* solids-free solution: precious liquids, corrosives, toxic fluids, volatile compounds. As for safety . . . *Electri-Cand* pumps rated up to 91 psi are UL approved for Class I, Group D hazardous locations — nearly twice the approved rating of any other "canned" pump.

Removable, straight can design simplifies field inspection and maintenance. Choice of non-metallic sleeve type or *Fluid Piston* bearings . . . tailored to your application. Bearings take care of themselves . . . are lubricated by the pumped liquid.

For efficient, safe handling of "problem" liquids, contact your A-C representative, or write to **Allis-Chalmers,** Industrial Equipment Division, Milwaukee 1, Wisconsin.

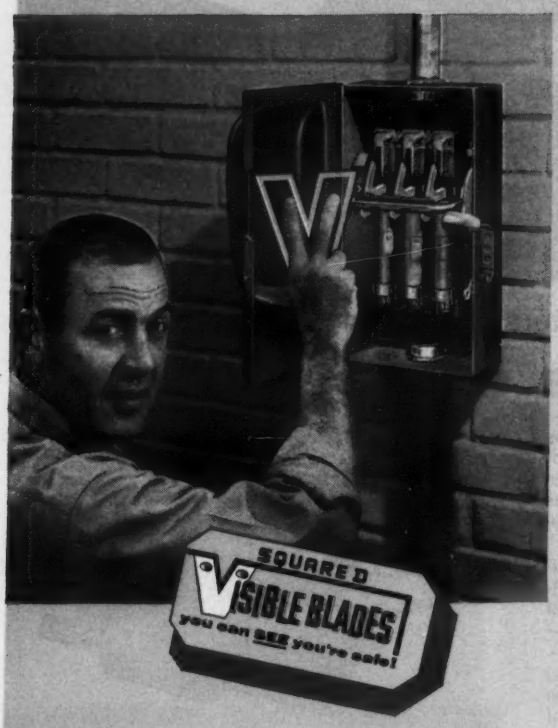


Another **Electric-Cand** pump exclusive: removable, reusable sealing cans. In the event of stator failure, simple maintenance procedure is to repair the stator and reuse the original "can." Saves trouble; saves time; speeds pumps back to service. *Electri-Cand* and *Fluid Piston* are Allis-Chalmers trademarks.

ALLIS-CHALMERS A-1519

Check 5125 opposite last page.

FOR SAFETY YOU CAN SEE REMEMBER THE "V" FOR VISIBLE BLADES!



• The men who pull the switches will tell you what can happen when a switch, *believed* to be open —*isn't*. A lot of things can happen—and every one of them is bad. Personnel safety is in jeopardy. Motors can single-phase. Machinery and work can be damaged. Down-time can skyrocket.

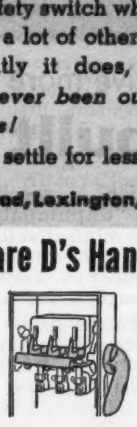
Doesn't it make sense to insist on Visible Blade construction which gives you a road block against any of those possibilities? Doesn't it make equally good sense to insist on the safety switch which gives you that construction—plus a lot of other performance advantages? Evidently it does, because *Square D switches have never been out of first place in more than 50 years!*

They cost no more...why settle for less?

Square D Company, Mercer Road, Lexington, Kentucky

Extra Safety with Square D's Handle Design

WHEN IT'S UP IT'S ON!



WHEN IT'S DOWN IT'S OFF!

Handle is integral part of switch, not cover. When door is opened, handle remains attached to switch. Eliminates hazard of false handle indication or defeat of padlock provision. When it's padlocked, it's locked!

SQUARE D COMPANY

wherever electricity is distributed and controlled

Check 5126 opposite last page.

letters from readers

Co-ops & opponents both throw rosebuds (We must be living right!)

Dear Sir:
I appreciate the manner in which you handled the rebuttal statements to some of the criticism of farmer cooperatives' tax position. "(Should co-ops pay 52% Federal income tax?," May, CP, p. 29.)

Granting that there are two sides to this story, I feel that your presentation gives the reader a reasonable opportunity to see both sides.

HAROLD HAMIL
Director of Information
Consumers Cooperative Association
Kansas City, Mo.

Gentlemen:
Your fine article concerning the problem of Federal income tax and cooperatives will prove beneficial to all segments of normal tax-paying industry. A better understanding of the significance of the co-ops' competitive advantage resulting from their tax privilege is absolutely necessary. It has been my opinion for many years that unless this advantage is corrected the unrestricted growth of cooperatives will place in peril all private industry with whom cooperatives compete.

Certainly the emergence of the giant industrial cooperative, with substantial investments in processing facilities, is evidence of their rapid and vigorous growth. Tax advantages have encouraged and accelerated this growth (much of it at the expense of tax-paying industry).

The small farm cooperative is no longer the general rule. Tax laws have encouraged the creation of cooperatives which have, in fact, become substantial aggregations of capital used for the purpose of manufacturing or processing. They are in reality cooperatives of

To page 16

For more information on product at right, specify 5127 . . . see information request blank opposite last page.

☆☆☆☆

4-STAR COMMERCIAL

about CELANESE INTERMEDIATES

TRIMETHYLOLPROPANE

A good base to start from. Celanese trimethylolpropane is making life easier for manufacturers of polyurethane foams and alkyd paints. Used as a base for polyethers in urethane foam production, TMP imparts improved toughness and heat distortion points, as well as better chemical resistance. As a component in alkyd coating resins, trimethylolpropane increases hardness, flexibility, color retention and resistance to heat and chemicals. And its price is very realistic.

ACRYLATE ESTERS

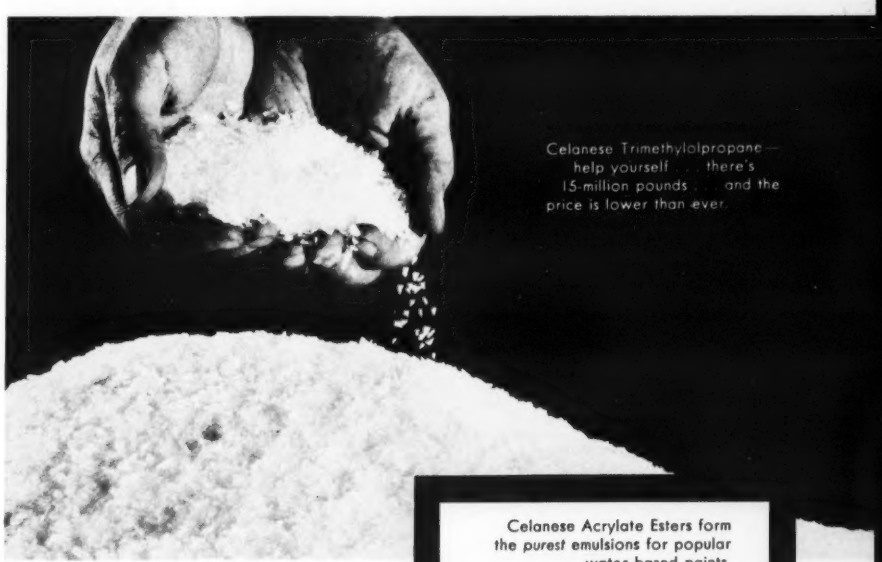
Pure. It's no secret that water-based paints are here to stay—nor that the best of them are made with the purest emulsion base. That's where Celanese shines—for the purest acrylates you can buy are those made by the unique Celanese beta-Propiolactone process. And you needn't take our word for it. Gas chromatograph results are proof-positive. We'll be glad to send you pertinent information on methyl, ethyl, butyl and 2-ethylhexyl acrylates.

1,3-BUTYLENE GLYCOL

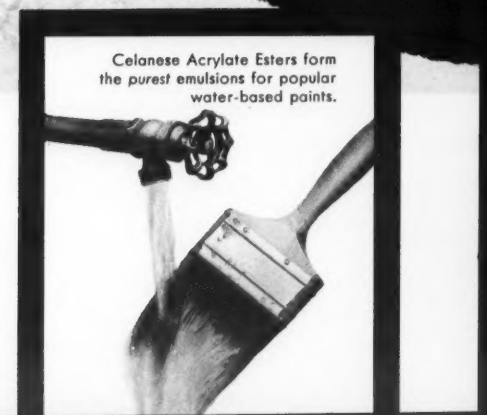
We're big in 1,3-BG. Celanese now has a 25-million pound production capacity for this versatile 4-carbon diol. Fact is, we're the only U.S. producer now offering 1,3-butylene glycol in commercial quantities. Whether you produce polyesters, polyurethanes, surface active agents, polymeric plasticizers, humectants, or coupling agents, only 1,3-BG does so many things so well. There's no rationing on 1,3-butylene glycol. Get all you want promptly from Celanese.

2-ETHYLHEXANOL

Quality tells. Celanese is now producing this intermediate with *outstanding quality*—in commercial quantities. Plasticizer manufacturers are using 2-ethylhexanol widely for making DOP or bis (2-ethylhexyl) phthalate. It is also used as a component for surfactants, herbicidal formulations, and in applications utilizing its defoaming characteristics. 2-ethylhexanol is used in the manufacture of Celanese 2-ethyl hexyl acrylate, noted for high-purity.



Celanese Trimethylolpropane—help yourself . . . there's 15-million pounds . . . and the price is lower than ever.



Celanese Acrylate Esters form the *purest* emulsions for popular water-based paints.

For more information on any of these Celanese intermediates, mail the coupon on the reverse side of this page.

Celanese
CHEMICALS

LOOKING FOR HIGHER PROFITS?

...in high-solids resin production

Try Celanese Paraformaldehyde, the low-price, free-flowing white solid. It's composed of approximately 91% formaldehyde and, obviously, very little water. It's practically unbeatable for the production of high-solids resins —urea, phenolic and resorcinol— which must be dehydrated for optimum properties. This thirsty chemical gives you two-and-a-half times as much formaldehyde per unit of formalin, which means larger yields of resin from acid or caustic catalyzed condensation reactions—in considerably less processing time. What's more, paraformaldehyde eliminates sewage disposal worries, too—there's a lot less water to start with.

Incidentally, paraformaldehyde is one of the most uninhibited chemicals around. Side reactions and resin yield losses are held to a minimum because paraformaldehyde contains no side agents or inhibitors. Which is not to say that Para isn't budget conscious. It is. For one thing, it can be stored in facilities that cost a fraction of what specially insulated storage tanks for formalin do. And it keeps a sharp eye on utility bills, too, since its shorter processing time requires less steam, power and water consumption.

Want more specific information? Just fill out the coupon and "drop it off" to us—now! We will rush you helpful product data by return mail.

1-C

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For more information on product at right, specify 5128 see information request blank opposite last page.

STEPHENS-ADAMSON

moves bulk material en masse vertically — horizontally — on inclines or around bends with

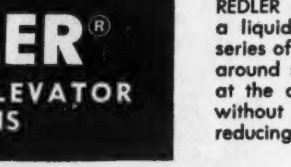
REDLER®

CONVEYOR-ELEVATOR SYSTEMS

S-A REDLER Conveyor-Elevators have a coveted 25 year reputation of successful operation. Well over 20,000 units handle a wide range of pulverized, granular, small lump and flaked materials in plants throughout the world. The REDLER Conveyor-Elevator moves material by EN MASSE action horizontally, vertically, on inclines or around bend corners. Material movement is continuous within totally enclosed, dust-tight compact casings, permitting large tonnage handling in small space. REDLER Conveyor-Elevators can be adapted to removing solids from a liquid bath in solvent extraction plants. The conveying elements, a series of U-type skeleton flights shown above in cut-away, move readily around sprockets and bend corners with relatively low power required at the drive. Skeleton flights may be easily unhooked and replaced without tools. S-A REDLER Conveyor-Elevator Systems speed efficiency reducing bulk materials handling to lowest cost per ton.

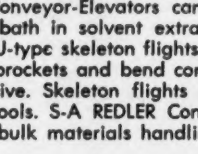
L-TYPE REDLER

Lower run can be horizontal or inclined. Elevating run can be operated at any required inclination. Special discharge openings can be spaced anywhere. Discharge to any one of three sides. Many variations of standard L-Type system available.



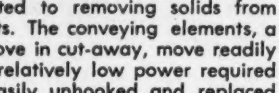
Z-TYPE REDLER

Combines two horizontal conveyors and one vertical elevator into one compact unit. One feedpoint, one discharge and one drive. Feed from choked feedpoints on horizontal run.



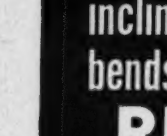
LOOP BOOT HORIZONTAL REDLER

Simplest form for elevating material up steep inclines. Column of material is supported on all four sides at inclines above the angle of slide for materials handled. Low headroom for feedpoints. Discharge gates placed wherever needed.



HORIZONTAL CLOSED CIRCUIT REDLER

"Run-around" type system employs side-pull conveying element. Permits conveying in several directions on horizontal plane. Available in two-way version featuring 180° bends and four-way version featuring 90° bends.



WRITE FOR BULLETIN 358

S-A
ENGINEERED BULK HANDLING SYSTEMS
SPEEDWALK® PASSENGER CONVEYORS
SPHERCO® BEARINGS & ROD ENDS

ENGINEERING DIVISION

STEPHENS-ADAMSON MFG. CO.

GENERAL OFFICE & MAIN PLANT, 11 RIDGEWAY AVE., AURORA, ILL.

PLANTS LOCATED IN: LOS ANGELES, CALIF. • CLARKSDALE, MISS.
BELLEVILLE, ONT. • MEXICO CITY, D. F.

Check 5129 opposite last page.

LETTERS

From page 14

capital investors.

The income profits of these cooperative ventures come not from members joining together with other members in marketing the produce of their farms, or in exercising their collective purchasing power, but from the use of their capital, together with the capital of others, in the manufacture of products for sale.

Yet, by virtue of our present tax system, the competitive advantages accruing to these investors are of such magnitude as to cripple—and will eventually destroy—competitors that are required to pay up to 52% of their net income into the Federal treasury.

I congratulate you on an excellent analysis of the situation, and commend to your readers a thoughtful reflection on the consequences of congressional delay in correcting this tax inequity.

JOE E. CULPEPPER
Senior Vice President
Spencer Chemical Company
Kansas City, Mo.

Gentlemen:

Recognizing that this is a story on cooperatives, it is understandable that the major attention in the story is devoted to cooperatives and their defense of their tax position. It does seem, however, that more attention might have been devoted to the position of some chemical companies than three paragraphs. This, of course, is a matter of emphasis rather than interpretation.

RICHARD D. LAMBERT
Media Relations
Representative
Manufacturing Chemists' Association, Inc.
Washington, D.C.

Detergents Addendum

To the Editor:

The problems caused by the presence of alkyl benzene sulfonates in waste water are not expected to disappear in the near future. Because of the

increasing use of detergents, both in the home and in industry, plus the fact that detergents recently introduced show greater resistance to decomposition by bacteria, we might expect increasing difficulty.

In fact, the creation of real and disturbing problems for public health and sewage disposal authorities throughout the U.S. and in other industrialized nations has been apparent to all.

One way to alleviate these problems would be increased usage of the commercial detergents which contain an ABS that is more easily degraded by bacteria than the tetrapropylene-based ABS, the most widely used type of ABS today.

We know that alkyl benzene sulfonates derived from selected petroleum fractions such as natural kerosenes are more susceptible to bacterial degradation that ABS derived from tetrapropylene. The evidence in support of this observation appears well-founded by experimental studies.

As a basic supplier of detergents to the industrial and household trade, Allied Chemical's National Aniline Division has long been interested in the effects of ABS in waste water.

Published experimental tests have shown the concentration of sodium kerylbenzene sulfonate in river water at 18° to 19°C is reduced from 5.0 ppm to 2.0 ppm in seven days and to 1.4 ppm in 13 days. By comparison, sodium tetrapropylene benzene sulfonate is reduced from 5.0 ppm to only 4.2 ppm in seven days, and is reduced to only 2.3 ppm after 21 days.

Wider use of kerosene-based ABS may not provide the final answer, but we believe it can lead to a significant improvement over existing conditions in certain areas, especially during periods of water shortages.

L. C. WIZEMANN
Manager-Detergents
National Aniline Division
Allied Chemical Corporation
New York

University surveys indicate:

STARTING SALARIES OF ENGINEERS ARE DECEPTIVELY HIGH

By James M. Jenks

TWO SEPARATE STUDIES of the salaries made by college graduates appear to contradict the commonly held belief that engineers today make out better financially than their classmates who major in non-technical subjects.

Both surveys were conducted by large universities. The first polled graduate engineers; the second, company executives. And both resulted in identical findings! That is, the average engineer today – despite a deceptively high starting salary—climbs fast but not far.

The need for technically trained men in recent years has exceeded the supply to such an extent that companies have been forced to bid for their services—to actually set-up "recruiting" offices on college campuses all over the country. Thus, starting salaries have gone up and up. But the income ceiling for these technically-trained men is lower than that for managerial personnel.

Despite the substantial head start engineers have, the differential in money earned over a ten-year period averages out at $7,000 more for the management man.

And from the tenth year on, the administrator's salary obviously outstrips that of the engineer by a wider and wider margin.

This, of course, is not to say that engineering students would be wise to shift to the study of business administration—or that working engineers face a bleak future. Quite to the contrary, the continuing growth of technology means that men with technical backgrounds are as ideally qualified for the highest rewards industry has to offer—*if they also have a knowledge of the underlying principles of business.*

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conventions and exhibits

Aug. 15-17. Cryogenic Engineering Conference, University of Michigan, Ann Arbor, Mich.

Aug. 15-18. Testing Conference, Technical Association of the Pulp and Paper Industry, Queen Elizabeth Hotel, Montreal, Quebec.

Sept. 3-8. American Chemical Society, 140th National Meeting, Chicago, Ill.

Sept. 5-8. 11th National Chemical Exposition, International Amphitheatre, Chicago, Ill.

Sept. 11-12. Chemical Market Research Association, Sagamore Hotel, Bolton Landing, Lake George, N.Y.

Sept. 11-13. Technical Association of the Pulp and Paper Industry, Corrugated Containers Conference, St. Francis Hotel, San Francisco, Calif.

Sept. 11-15. Instrument Society of America, Fall Instrument Automation Conference and Exhibit, Memorial Sports Arena, Los Angeles, Calif.

Sept. 14-17. Drug, Chemical & Allied Trades Association, Annual Meeting, Pocono Manor Inn, Pocono Manor, Pa.

Sept. 19-21. TAPPI and Canadian Pulp Association, 4th International Mechanical Pulping Conference, Edgewater Beach Hotel, Chicago, Ill.

Sept. 24-27. National Power Conference, American Institute of Electrical Engineers and American Society of Mechanical Engineers, St. Francis Hotel, San Francisco, Calif.

Sept. 24-27. American Institute of Chemical Engineers, 45th National Meeting, Lake Placid Club, Lake Placid, N.Y.

Sept. 28-30. Chemical Division,

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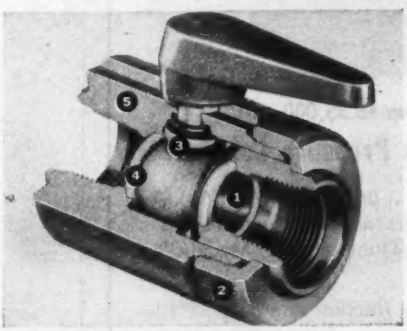

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... Meetings and shows of interest to the chemical industries

American Society for Quality Control, 5th Annual Chemical Conference, Daniel Boone Hotel, Charleston, W.Va.

Oct. 1-5. Electrochemical Society, Statler Hotel, Detroit, Mich.

Oct. 4-6. Deinking Conference, Technical Association of the Pulp and Paper Industry, Harris Hotel, Kalamazoo, Mich.

Oct. 4-6. National Association of Corrosion Engineers, Western Regional Conference, Benson Hotel, Portland, Ore.

Oct. 9-11. Plastics-Paper Conference, Technical Association of the Pulp and Paper Industry, French Lick-Sheraton Hotel, French Lick, Ind.

Oct. 15-19. TAPPI Engineering Conference, Shoreham Hotel, Washington, D.C.

Oct. 18-19. Commercial Chemical Development Association, Palmer House, Chicago, Ill.

Oct. 18-20. 23rd Annual National Packaging Forum, Packaging Institute, Biltmore Hotel, New York City.

Oct. 24-27. National Association of Corrosion Engineers, Conference and Exhibition of 1961, Shamrock Hotel, Houston, Texas.

Oct. 29-*Nov.* 1. National Agricultural Chemicals Association, Annual Meeting, Homestead, Hot Springs, Pa.

Oct. 31-*Nov.* 4. Federation of Societies for Paint Technology, 39th Annual Meeting and 26th Paint Industries' Show, Shoreham Hotel, Washington, D.C.

Nov. 7-10. Packaging Machinery Manufacturers Institute Exhibition, Cobo Hall, Detroit, Mich.

Nov. 27-*Dec.* 1. 28th Exposition of Chemical Industries, Coliseum, New York City.

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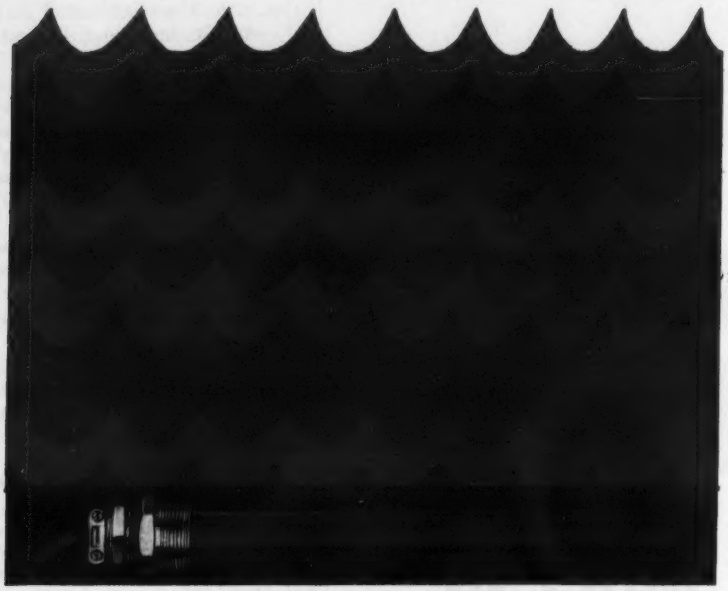

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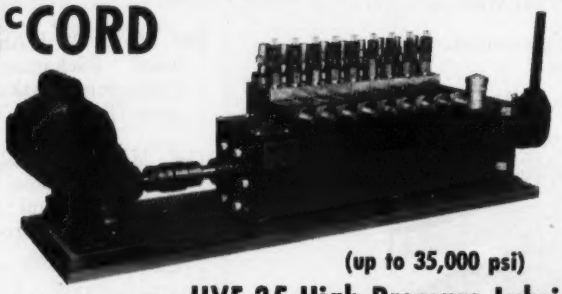

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Watching Washington

Is Russian CPI Losing Bug-killer Race?

SILLY STATISTICS DEPT — Add this to your file of conversation pieces: The Soviet Union lags seriously behind the U.S. in production and use of insecticides to control plant pests.

From time to time, the USSR encourages criticism of some aspects of its operations. Observers in Washington believe this criticism is virtually "ordered" to make non-criticized areas look better. The latest "frank" articles appeared in the *Journal of the All-Union Chemical Society.*

One of the articles points out that over the past 12 years in the U.S. the production of organic compounds to control plant pests, diseases and weed growth has increased five-fold. Such an increase has not been possible in the USSR, the article states. Had such production and use of non-fertilizer agricultural chemicals been possible in Russia, the author believes, between five and 300 rubles could have been saved for every ruble spent on the chemicals.

Another article admits that the U.S., England and Germany have the technology for producing concentrated pesticidal preparations containing up to 75% of the active ingredient, since these countries have a "sufficiently powerful production of surface-active substances, solvents and fillers, as well as highly effective grinding apparatuses."

"The insecticide industry of our country has lagged behind these capitalistic countries," the article continues, "in production technology in the production of high concentrated wetting pesticidal powders chiefly as a result of a limited assortment of surface substances and fillers."

Complete translation of all three papers, under one cover, is available from the Office of Technical Services, U.S. Department of Commerce, Washington 25, D.C. The price is $2.50. Request #61-21005.

FREE SAMPLES FOR SALE — Repackaging of physicians' samples, recently spotlighted by the Food and Drug Administration, may be costing drug manufacturers up to $320 million per year in lost retail sales. As FDA poured through the Kefauver Committee files to get part of its information, the agency learned that many drug manufacturers devote 20% of their output to samples, and at least one firm admitted that sometimes half of its production went free to physicians.

Until recently it was thought that physicians used these samples to examine their results on patients. Some physicians do. However, Food and Drug Commissioner George P. Larrick has revealed that "repackaging" houses have been buying these samples from physicians for lucrative resale. Testimony during Kefauver hearings pinned the drug industry's output at $1.8 billion per year. This means about $320 million per year in samples is available to repackagers, one FDA official estimates. And he calls his estimate "realistically conservative."

FDA calls drug repackaging for resale a "mushrooming abuse." The agency has seized several packagers' inventories, including one inventory of a potent drug for treating mental depression (Tofranil) that was mistakenly labeled as a mild vitamin preparation by untrained personnel.

The first actions were against Marshel Sales Co., Palisades Park, N.J., and Fall Drug Co. Jersey City. The repacked articles included Diuril and Hydrodiuril (for treatment of high blood pressure); Chloromycetin, Aureomycin, and Terramycin (antibiotics); Equanil and Placi-

dyl (tranquilizers); Premarin (a hormone); Thorazine (central-nervous-system depressant); and others.

The Government's major brief against repackaged drugs is that they are not labeled as required by the Food, Drug, and Cosmetic Act. The labels do not bear the statement: "Caution: Federal Law Prohibits Dispensing Without a Prescription." The labels do not reveal the common or usual names of the drugs.

Another major complaint, also against labels, is that the repackaged drugs are dangerous in that the labels do not carry the manufacturer's name and the lot or control number. Commissioner Larrick points out: "The conditions found in repackaging of these physicians' samples short-circuit or nullify the essential safety controls required before marketing."

Repackagers buy from a number of sources. Recently they have spread their activities through direct-mail campaigns.

One post card, for example, reads:

"Dear Doctor:

"Don't throw away your surplus drugs or samples. I will buy them from you. I will pay a fair, honest price. Please write or phone."

The card was mailed to physicians by Nathan H. Baier, a large drug repacker located at Shiller Park, Ill.

A new twist is the offer of needed materials and office supplies, instead of cash, for unused samples. A typical letter:

"Dear Doctor:

"During the past several months you have undoubtedly accumulated a great deal of surplus physicians' samples. We are certain that you will appreciate an opportunity to exchange this surplus collection for your everyday office necessities . . . The complete range of items we have available are listed on the enclosed sheet. They are not for sale but are given to you in exchange for your surplus samples . . . This type of arrangement is commonplace practice

To next page

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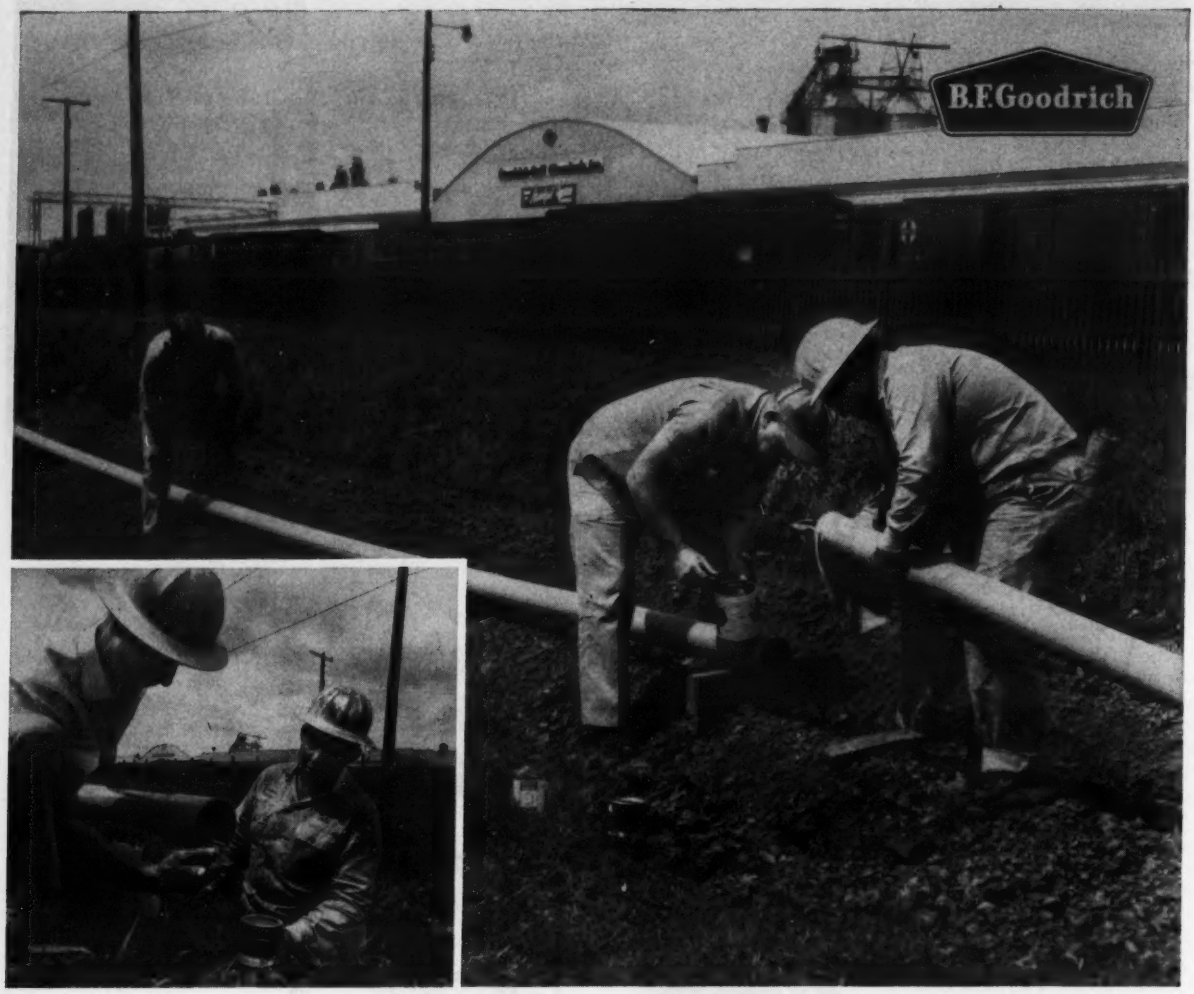

"Bringing in brine by pipe of Geon instead of tank trucks cuts our costs"

"When we used to have our saturated brine delivered daily by tank truck," says the superintendent of the Goodrich-Gulf Chemicals, Inc., plant at Port Neches, Texas, "the trucks created traffic problems and receiving equipment created peak pressures on plant and manpower—often at the wrong time. Now we're sure of a continuous supply of brine with minimum receiving problems."

Texas Brine Corporation likes the new arrangement, too. Since laying 12,000 feet of rigid vinyl pipe, their cost of delivery has been reduced to the cost of automatic pumping.

The pipe was easy to install, too. No wonder. Geon pipe is lightweight, can be joined by solvent welding—as is being done in the photo above. Geon in unaffected by most causes of corrosion—the brine can't harm it, and ground currents or inside deposits will never be a problem. It will continue to provide low-cost delivery for as long as it's needed.

Here's another example of the way that rigid Geon can solve piping problems. In other products, Geon provides whole new advantages, sometimes opens whole new markets. For information, write Dept. NJ-4, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio.
In Canada: Kitchener, Ontario.

B.F.Goodrich Chemical
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Geon VINYLS

Check 5135 opposite last page.

in many localities throughout the country . . ."

Some repackers contact physicians at random but, says FDA, others rely on the cooperation of a small number of physicians who deliberately obtain samples and complimentary packages from the drug manufacturers to sell to the repacker. A Brooklyn physician was supplying drugs to a single repacker to the extent of some $10,000 a year.

However, FDA said it has no evidence that physicians generally dispose of their samples improperly. One source of physicians' samples is the detail man who supplements his income by selling directly to the repacker.

Some of the repacking operations are virtually one-man establishments where the operator himself does the repacking. In the larger establishments FDA has found several employees, some of whom are wholly untrained people.

In some establishments the repacked material is either unlabeled or labeled only with the name of the drug. FDA says other operators utilize a photographic copy of the original manufacturer's label with an added legend showing that the merchandise was repacked by that particular firm. One printing house in Brooklyn makes a business of supplying such photographic copies. On these copies the control number is left blank presumably so the repacker can enter the control number which appears on the sample packages. FDA said this is not always done.

PLASTIC SOLDIERS? — The Defense Department has published a "Technical Resources Directory in Plastics" available to chemical processors through the Commerce Department. The publication is designed to "encourage maximum communication between U.S. military agencies and the plastics industry."

The 147-page "Technical Resources Directory in Plastics" is available for $2.75 from the Office of Technical Services, U.S. Department of Commerce, Washington 25, D.C. Request PB 171 036. ■

OPERATING MANAGEMENT'S OWN MAGAZINE

August 1961

CHEMICAL PROCESSING

What Is EVOP?

EVOP or evolutionary operation is a statistical technique that lets the operating manager look at more than one variable at a time. It lets him measure the effect of interaction. Method was developed by George E. P. Box

Here's how you can use EVOP

Saves Tennessee Eastman $25,000/yr on a single process

By S. DAVID PURSGLOVE

THE Tennessee Eastman Company recently initiated a new batch-type process in one of its plants at Kingsport, Tenn. After early shakedown and some modifications, the average yield was a satisfactory 562 pounds per batch — about what could be expected.

Then came onto the scene a committee of chemists and production men well known through the plant as men never fully satisfied with any operation. They brought with them some ideas, a blackboard, and a conviction that any good process always can be made better.

They started playing games with the process. On one batch they added a little more acid; another batch would get a little less. Some batches got longer reacting times; others were shorter.

Where was the production superintendent while all this was going on? Was he hounding the plant manager, screaming for protection from "outside meddlers?" Hardly. He was right in the thick of the game, adjusting, controlling and always writing numbers in little boxes on the blackboard.

When the game was over, less than a month after it started, the production superintendent was proud that he had been one of the "meddlers" who increased the yield from 562 pounds to 588 pounds per batch. He was a key member of a group whose game saved Tennessee Eastman $25,000 per year on a single process.

The game: Evolutionary Operation.

The group of "meddlers:" The EVOP Committee.

This is not an isolated case of unusually good luck in optimizing a process. There was no "by-guess and by-golly" hunch-playing involved. Every step was carefully planned and the committee knew what to look for as clues to success or failure of each step. Never was there the familiar hestitancy followed by the fearful plunge into a gamble that might lose product, lead to downtime or increase costs. Most important to chemical industry production men, the Eastman process, which cannot be named, was not a special set of favorable circumstances.

EVOP Used By Eastman On 15 Processes

Tennessee Eastman has used evolutionary operation (EVOP) effectively to increase yields and lower costs on more than 15 processes. Eastman is not unusual in this respect. A member of the EVOP committee was asked whether he thought Eastman was typical of the industry in use of evolutionary operation.

Ralph E. DeBusk, an Eastman control and development chemist who has had wide contact with EVOP users, says Eastman's operations are typical of those companies that use the technique. TEC's experiences, successes and stumbling blocks seem about the same as those of other EVOP users. However, he pointed out that many companies still have not adopted EVOP.

Most of the industry's leaders are using EVOP. A spot check shows that the heaviest users are Chemstrand, American Cyanamid and Monsanto. Some others that use the technique extensively are Dow, Du Pont, Union Carbide and Phillips Petroleum.

What is EVOP and what makes it different from routine good production management? A good production chief constantly seeks increased yields and lowered costs. Where called for, he seeks to raise quality. The classic approach is to select process variables and play with each, one at a time. However, an adjustment of one variable that seems to enhance the process may not be a wise move when some other variable is altered. Or, an adjustment that produces little results may really be the key move to make if the production chief only knew that simultaneous adjustment of another variable would result in favorable interaction.

Evolutionary operation is a statistical technique that lets the production chief look at more than one variable at a time. It lets him measure the effect of interaction. A description of why its developer, George E. P. Box, chose the name "evolutionary operation" provides an insight into how the technique works.

Dr. Box points out that living organisms advance by one of two mechanisms:

1. Genetic variability due to such agencies as mutation.
2. Natural selection.

To next page

Advantages Of EVOP

1. Two or three factors may be evaluated in one operation
2. Many responses may be observed in one operation
3. The process is producing data as well as product
4. Procedure is designed for precision
5. It establishes a range of validity
6. Method is designed for simplicity
7. A calculation of uncertainty is included

Here's how to use EVOP *From preceding page*

By analogy he reminds chemists and production men that processes advance — improve — by two similar mechanisms:

1. Discovery of a new route for manufacture
2. Adjustment of process variables to their best levels.

Evolutionary operation draws on the second choice of each pair. Dr. Box points out that there are two essential features in natural selection that are essential, too, to EVOP: variation and selection of favorable variants.

Information Board Key to Process

In a nutshell, the production man practicing EVOP, or the EVOP committee, spots the variables in the process, provides variation by altering the variables, lays out the variations with their results for all to see, then selects the favorable variants. He then chooses the combination of variations that produces the most favorable result as registered before him. This makes one major key to EVOP the "information board," a concept not foreign to statistics as practiced in other fields.

The information board can be chalk on a blackboard, grease pencil on white plastic, or magnetic letters and numbers on a steel board. Any combination is satisfactory so long as it is easy to remove a number and replace it with another.

The other major key to successful EVOP is a knowledgeable EVOP committee with management backing. At Tennessee Eastman, EVOP committees are formed of at least one person very familiar with the EVOP technique, chemists and production people familiar with the process to be studied, and — always — the production manager in charge of the process. Says DeBusk: "Here, and most places, the production supervisor can call a halt whenever he believes it advisable. After all, he has the final say-so; he is responsible for quality and cost of the product."

Does this tie up an imposing aggregation of costly talent? No, says TEC. Often the committee is but a few men, since the talents needed very often overlap. Sometimes, the EVOP committee is just one man: when the production supervisor is also a chemist who understands the process as well as a statistician who is familiar with evolutionary operation. In any event, large committee or small, the committee time required of its specialist members in most companies averages one afternoon per month.

Ideally — and most EVOP's depart but little from the ideal — here is the way Dr. Box suggests setting up an EVOP program:

- Make provision to introduce a routine of systematic small changes in process variable levels.
- Provide feedback of results of these changes to the production supervisor and EVOP committee.
- Make the feedback more manageable by way of the information board (or three dimensional model in some cases) set up in the supervisor's office, on the plant floor, or both.

Personal Relations Plays A Part

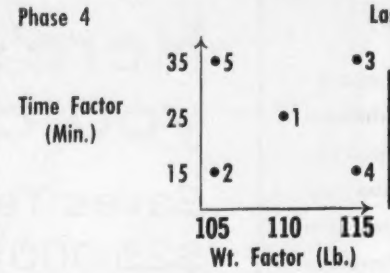
Dr. Box is greatly interested in the relationship between EVOP and production line personnel. He points out that the calculations leading to entries on the information board must be simplified so that they can be performed by the non-technical person, and so the average process worker will be brought into the operation. In this sense, he reveals some personal industrial psychology: "One consequence of EVOP is to produce more careful operation of the process."

The calculations that result in figures for the information board should be prepared by a statistician or a member of the professional staff familiar with the mathematics needed. However, Dr. Box suggests that these calculations be used only behind the scenes to prepare standard calculation work sheets that involve little more than simple addition or subtraction.

To the actual EVOP operation then, the calculations which have required long treatises for their explanation to statisticians becomes little more than open-blank information sheets — plug in the data and crank out the answer! Dr. Box teamed with J. S. Hunter, of Princeton University, to present in short form the calculations necessary to set up an EVOP. The "simplified" description of the calculations occupied 19 pages of *Technometrics*, Vol. 1, No. 1 (1959), publication of the American Society for Quality Control and the American Statistical Association (William Byrd Press, Inc., P.O. Box 2W, Richmond 5, Va.).

Should this shake the production chief who is eager to use evolutionary operation techniques to improve a process? Even Dr. Box denies it. After all, he contends, even though a proper approach to calculations is important, "EVOP depends more upon a wise choice of variables to be studied and on an intelligent appraisal of the results of the calculations."

Information Board
Two-factor Evolutionary Operation



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Weight Factor	+4.0	±3.3
Time Factor	+2.0	±3.3
Interaction	−4.0	±3.3
Change in Mean	−4.0	±2.9
St'd. Deviation	+4.2	

Can Be Used In Many Processes

Evolutionary operation can be used in a wide variety of processes. It is especially useful to scale up a process from the lab to the plant. Optimum laboratory conditions usually bear little resemblance to optimum plant conditions; usually they provide only a starting point for experimentation on the line. Of course, the uses for EVOP go far beyond bringing a process into the plant. Here is how Tennessee Eastman's DeBusk views the areas of effective use:

1. Minimize production cost
2. Maximize production yields
3. Minimize yields of undesirable side products
4. Reduce the tie up of processing equipment
5. Increase the productivity of existing equipment
6. Evaluate process variables

The company has found that

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An engineering-education revolution is spawning a new breed —

The chemical engineering-scientist and how he got that way

By **GEORGE BANGS**
Assistant Editor

Here and there at first, and eventually in a floodtide, you will find a new type coming out of the chemical-engineering schools in coming years. He will not be quite as familiar with the equipment aspects of processing as have his predecessors. But, give him pencil, paper and a computer, and he can tell you more about your process in a few months than you have learned in years. He is the chemical engineering-scientist— trained not in the unit operations, but in the fundamental aspects of the material, momentum and energy transfer processes. Successful utilization of this man's unique training and capabilities poses a tough problem to operating management — accustomed to dealing with the classically oriented chemical engineer. Understanding the background of the chemical engineering-scientist and the revolution that produced him is the first step to such successful utilization

THERE is a revolution well under way in the chemical-engineering curricula of many schools across the land. Descriptive courses are being replaced by those on the theoretical level; the engineering-sciences are being taught in preference to the unit operations. (These engineering-sciences are listed in a box on the next page.)

As might be expected, this basic change in approach to chemical-engineering education falls far short of meeting with unanimous approval in the academic and industrial worlds.

Many persons feel that things have gone too far too fast, that workable empiricisms are being thrown out for impractical abstractions, and that many engineering educators are losing sight of the fact that chemical engineers have an entirely different function from that of scientists.

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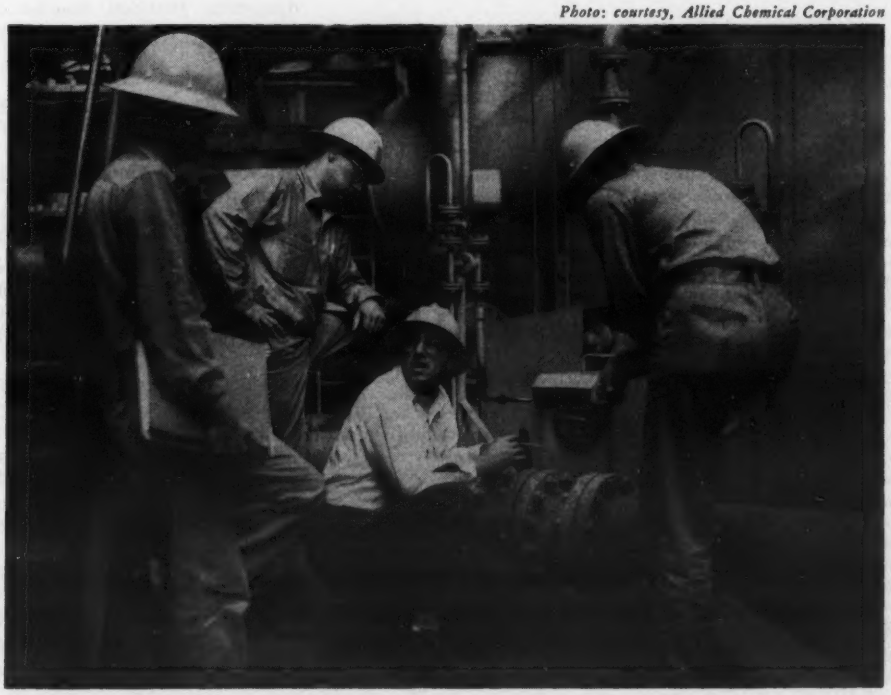
Photo: courtesy, Allied Chemical Corporation



***As the new generation** of chemical engineering-scientists are produced in increasing numbers by engineering schools, operating management will have to explore new approaches to help new graduates smoothly make necessary adjustments from academic to industrial worlds*

The chemical engineering-scientist *From preceding page*

These attitudes are easy to understand. The descriptive unit operations approach to chemical engineering has served the industry and its educators long and well. But times have changed.

A Century of Progress

A century ago, the industries that are today called the CPI were separate parts. These had been developed almost entirely by empirical methods over thousands of years. Ceramics, glass, pigments and paints, soaps, sugar, fermentation, bleaching and dyeing, paper tanning, explosives and metallurgy comprised this group. Inter-industry communication was virtually nil.

Although a good deal of progress took place in the latter half of the 19th century, it occurred without a real understanding of the basic principles underlying processes, nor any realization that these principles were common to all of the process industries. In a like manner, education was directed toward the needs of one industry or another, not setup to teach principles utilized in all of them.

The first attempt to systematize the study of chemical processes was made by George E. Davis in England. In 1887, he gave a series of lectures which were later, in 1901-1902, the basis of his, *A Handbook of Chemical Engineering*[1]. This publication presented many of the principles of unit operations.

In 1888 Lewis Mills Norton established the first curriculum in chemical engineering at MIT. It remained, however, for Arthur D. Little (a chemistry alumnus of MIT before the chemical-engineering instruction was initiated) to define fully in 1915 the concept of unit operations, although he referred to "unit actions"[2].

During the next three years, unit operations courses were developed at MIT. These were the basis of the classic text on the subject by Walker, Lewis and McAdams, *Principles of Chemical Engineering*, published in 1923[3]. For the most part, the unit operations approach has been the dominant influence in chemical engineering in education and industry down to the present day.

Why Change Now?

What then is behind the snowballing movement toward the engineering-science methodology and away from the more descriptive unit-operations orientation? Two major developments led to the extensive curricula-shifting now taking place: Physical changes have become of secondary importance in chemical processing, while the unit operations concept has developed into an influence for compartmentalization, not generalization.

The unit operations are concerned primarily with physical processes. This physical aspect of chemical processing is no longer dominant. Rapid strides have been made in such areas as thermodynamics, reaction kinetics and chemical-systems analysis to a point where the non-physical considerations have assumed major significance.

L. Bryce Andersen, associate professor of chemical engineering at Rice Institute, gives an interesting case in point with respect to chemical-engineering thermodynamics[4]:

"The classical text in chemical thermodynamics by Lewis and Randall, which among other things introduced the concept of fugacity, was published in 1923, the same year as the first unit operations text; but no significant text discussing the chemical engineering aspects of thermodynamics appeared until the Second World War.

"Until that time—and later—many chemical engineering departments were willing to have their undergraduates learn all of their thermodynamics from physical chemists and mechanical engineers. Only since the war have the highly important and highly quantitative aspects of thermodynamics of interest to chemical engineers been widely introduced at an early stage in the undergraduate program. In a sense, then, only since the war has thermodynamics been given the attention equivalent to that given unit operations in the undergraduate curriculum."

The development of the unit operations concept was of great value to the chemical industry in that it presented a systematic organization of a number of processing steps in a wide variety of industries. Principles of heat transfer, for example, could be applied to any step in the process.

Over the years, however, unit operations became an influence for compartmentalization, not generalization. Similarities among various types of heat transfer, again for an example, were taught, but no attempts were made to relate heat, mass and momentum transfer.

Each unit operation became a little area of specialization, much as each particular industry had so become prior to the advent of the unit operations approach. The process behavior as a whole, and the intricate relationships of the various unit operations, were not sufficiently emphasized.

Education For Obsolescence?

In the light of these developments, many educators began advocating a much more fundamental approach to chemical-engineering education. These people felt that the engineering-sciences should be taught in lieu of the more descriptive unit operations courses. They expressed concern that, unless such changes took place, chemical engineering would become stagnant and downgrade itself to the technician level.

As early as 1925, at the Conference on Chemical Engineering Education, Merle Randall said, "Again I say the thing we must do in chemical engineering is to delete the descriptive courses and have our chemical engineers take not only the cream of the fundamental courses in mathematics, physics, and chemistry, but also the cream of the theoretical engineering courses . . . "

At this same conference, F. H. Rhoades, of Cornell, said, "We have felt that it is perhaps more important to stress the theory not to the point of excluding information, but to emphasize the basic theory of chemistry and to give the man a thorough training in theoretical chemistry, in physics, and in the other theoretical fields.

"We have perhaps left some of the application of that theory untaught because we have felt that it would be unwise to teach the application to the exclusion of the theory; we have tried to strike a balance."[5]

To page 28

What are the engineering-sciences?

The engineering-sciences are evolved from two basic areas: mechanical phenomena of solids, liquids and gases and electrical phenomena. A generally accepted subdivision of these sciences is as follows[12]:

1) **Mechanics of solids (statics, dynamics and strength of materials)**
2) **Fluid mechanics**
3) **Thermodynamics**
4) **Transfer and rate mechanisms for processes (heat, mass and momentum transfer)**
5) **Electrical (fields, circuits and electronics)**
6) **Nature and properties of materials (relating atomic, particle and aggregate structure to properties)**

Educators differ sharply on the engineering-science revolution . . .

Many feel it is good and are acting accordingly . . .

"In the last two or three years all of the descriptive courses have been eliminated from the curriculum and have been replaced by the more theoretical courses, approached from a mathematical standpoint. The use of computers for calculations purposes and control are being integrated into the program. Automation and process control are being expanded."

"The trend toward elimination of empiricism will continue; engineering will become more scientific; the systems approach, already introduced in our process control course, will spread to other areas. In 10 years it will be more difficult to distinguish between engineering graduates and science graduates."

"I do not believe that any faculty man or student now in school is able to predict what the ultimate effect of the advanced use of computers will be, nor indeed, what the design of these computers will be like. One problem is that computer logic must be a way of life so that we can 'think' in logical language. One cannot express his thoughts accurately unless thoroughly familiar with the language he is using. We are now planning a freshman course for our engineers to teach them this language in the same way we teach English composition."

"As the solving of more complicated and complex problems is required of the chemical engineer, so must his training become more rigorous and difficult. Included in this training will be more advanced mathematics, a more theoretical approach to engineering design and analysis problems, and the creative qualities of the engineering student will be encouraged."

"Looking at the country as a whole, I personally consider the approach to chemical engineering education is obsolete. A few schools have recognized this status and are attempting to break the shackles of a framework and tradition which was excellent 30 or 40 years ago, but is completely inadequate for the preparation of engineers to cope with new technology and new environments."

"In general we have been headed in the engineering-science direction for the past ten years. We do not have any courses on technology as such in our curriculum, either graduate or undergraduate . . . The courses in our department are science-oriented. Our most recent curriculum changes were designed to incorporate a better understanding of the fundamentals underlying the unit operations and to put more emphasis on transient phenomena. We are attempting to introduce all of our undergraduates to basic concepts of process dynamics and process control. Our undergraduate students are introduced to the use of computers and apply them to engineering problems."

"In our curriculum in chemical engineering, we have reduced the purely descriptive courses to almost zero, and have cut to a minimum the amount of "technique" courses, such as chemistry laboratory and engineering drawing courses. We have increased the amount of mathematics, and we have introduced new material in chemical reactor design and automatic control."

"As to the future of chemical engineering education in the U. S., I feel that it needs to rise again to a position of engineering educational leadership. To my mind it is not a question of whether chemical engineers are too much involved in theoretical concepts of chemistry but rather a re-evaluation and realignment of their educational process to provide a stimulus and challenge for the talented young people who are looking toward careers in tomorrow's technology. I feel large adjustments in chemical engineering education are necessary."

"A recent revision of our chemical engineering curriculum considerably increased the emphasis upon science and mathematics. The science aspects of this revised curriculum are given considerably more weight than in the past. Noticeable is the added emphasis on mathematical analysis and the use of computers."

Others see dangers and are moving more cautiously . . .

"I maintain that engineering is still to a large degree an art, and whereas we are committed to teaching scientific principles we must always bear in mind that the majority of our students will soon be facing real engineering situations and they should be made to realize the limitations of a purely scientific approach . . . I believe that many well-meaning persons in the educational field are going too far along scientific lines and are doing their students a disservice by over-emphasizing science at the expense of engineering."

"The danger that must be guarded against is over-emphasizing engineering sciences to the extent that the students graduate oriented toward science and not toward engineering. If this happens, we, of course, are no longer training engineers."

"Although fundamentals are an important part of the curriculum, they are not important to the extent of completely excluding engineering or practical knowledge which involves applications of the fundamentals leading to creativity."

"Our philosophy here has been that first of all we, as engineers, are not scientists. It is our business to translate scientific discoveries into useful processes for the production of materials. This, of course, means that we must have sufficient background to understand what the scientists are doing in our area . . . I do believe we can put ourselves out of business if we move too far away from engineering in our curriculum."

"It is the feeling of our group that with the disappearance of cookbook-technology teaching from almost all chemical engineering curricula ten years or so ago that there was a good remaining balance between engineering and scientific aspects of the program. For this reason, there has not been a stampede of changes in pursuit of a 'scientific' program in a curriculum which is rather heavily tied to the scientific bases of physics and chemistry under any circumstances."

"At the present time, quite a few people are wondering whether we are on sound ground in forcing all our students to take the present science-oriented type of program, which doubtless is fine training for the young man who will ultimately go into research, and who probably will go on for graduate work after he receives his B.S. degree."

"The chemical engineer has always been science oriented, but his strength has been in judgment and in liaison between scientists and management. He must not lose this capacity by trying to be a scientist himself. He must, however, continue to use the most modern scientific methods in handling his very practical problems. There have already been indications that some graduating engineers refuse to concern themselves with problems requiring a balance of judgment and science and I believe this is most unfortunate."

"Chemical engineering is engineering and not science. Consequently, we feel that we must maintain a strong engineering basis for our curriculum. However, as 'engineering' principles and operations become better understood and are better interpreted and analyzed in terms of underlying and basic principles of science, the emphasis on science in the curriculum will grow. This does not necessarily mean, however, that we will drop engineering courses and add more science courses. It does mean that we will emphasize scientific principles more and more in our engineering studies."

Engineering education

From preceding page

These thoughts have been echoed and re-echoed with an increasing note of urgency in recent years by many chemical-engineering educators.

Don A. Fischer, dean of the School of Engineering of Washington University in St. Louis, feels that ". . . in chemical engineering as well as in all engineering, we must all stop being on the defensive and take a very objective look at what chemical engineers and all engineers will be doing ten years from now.

"We must try to fit into the future rather than fight it. I believe we must give every engineer a broad enough training in the fundamentals so that he can change his specialty with the changing times."

Such opinions reflect an increasing national concern over the need for more scientifically oriented curricula in all types of engineering education.

Norbert Wiener, MIT's father of cybernetics, feels that "the engineers can no longer hide behind their ironwork." James Killian, former MIT president, has stated, "A number of us are agreed that engineering nationwide is in something of a backwater—not so much with other countries as in terms of our potential relation to what has been happening in science."

To correct the situation, according to Robert F. Goheen, president of Princeton, the science of engineering should be emphasized during the four undergraduate years. In Goheen's opinion, training in specialized skills and technology should be left to industry.

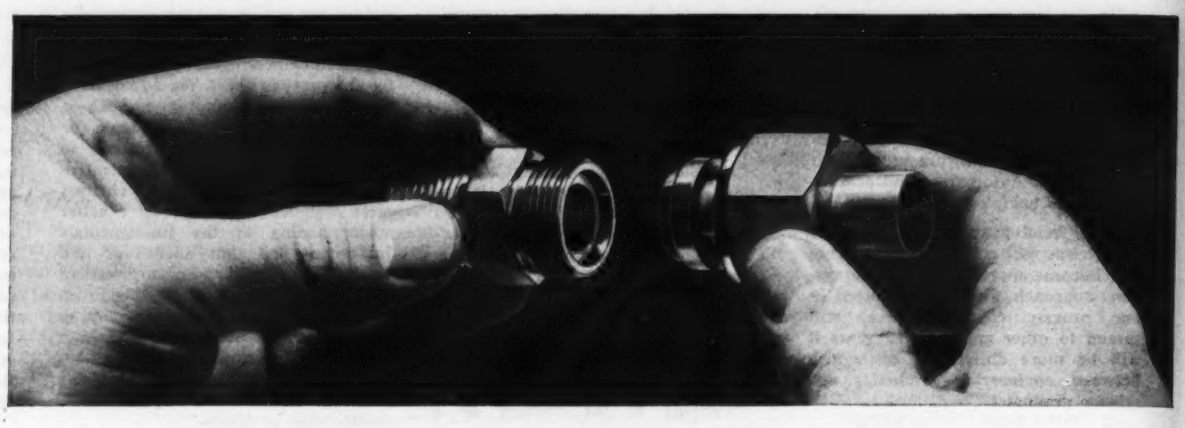
Enter: Engineering-science

The Committee on Evaluation of Engineering Education of the American Society for Engineering Education was appointed in May 1952 by ASEE President S.C. Hollister.

The committee was instructed to recommend a pattern or patterns that engineering education should take in order to keep pace with the rapid developments in science

PROBLEM: absolute reliability of a weldless tube fitting under super pressures, high temperatures, high-frequency vibration or shock

SOLUTION: BRAZE-SEAL



THIS BUTT-JOINT, MAKE-AND-BREAK FITTING WITHSTANDS WORKING PRESSURES UP TO 19,000 P.S.I.*

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9/16"	61,600	—
⅝"	61,600	46,200
¾"	60,000	45,000
⅞"	56,000	42,000
1"	52,000	39,000
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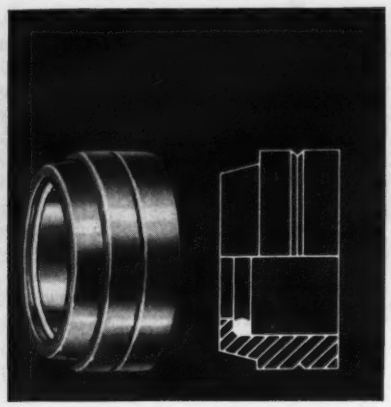
FITTINGS



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Inside the Braze-Seal fitting sleeve is a brazing ring of silver alloy. When the sleeve is slipped over the tube end and heated, the alloy forms a tough, lasting bond between the tube and sleeve. After brazing, the fitting is easily assembled —no special machining necessary, no special tubing required, no flaring, no danger of "over-torquing" the fitting because you can see when it's tight.

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This Braze-Seal acetylene torch simplifies the making of brazed joints. Six-flame jet on circular tip heats sleeve evenly—quickly brazes the silver alloy to form a super-pressure-tight seal.

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and technology, and to educate men who will be competent to serve the needs of and provide the leadership for the engineering profession for the next quarter century.

Findings of the committee were published in 1955 and have become known as the Grinter Report.[6] They concluded that scientifically oriented engineering curricula are essential to achieve such ends and recommended the specific means of implementation.

Among the recommended means of implementation were the identification and inclusion in engineering curricula of six engineering-sciences, to be taught as a common core of such curricula.

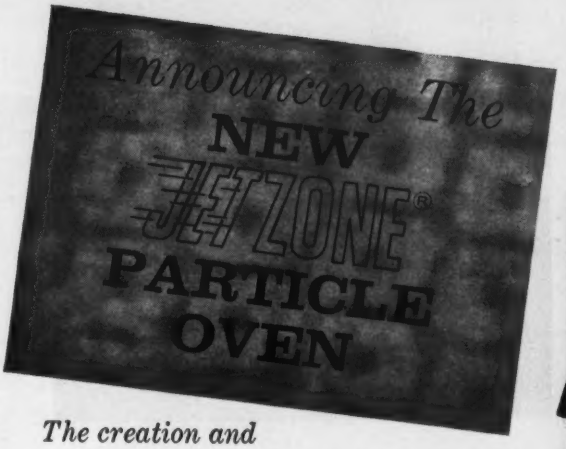
William Licht, of the University of Cincinnati, has made an interesting prediction with respect to the future of the engineering-sciences in chemical-engineering education[7]:

"The unification of treatment of operations of similar character through basic mechanisms . . . is bound to continue as more is learned of these mechanisms. It will make it possible to eliminate duplication of study which is inherent when the operations are each considered individually. This will help point the way to organizing college courses more efficiently and relieving some of the time pressure in the curriculum.

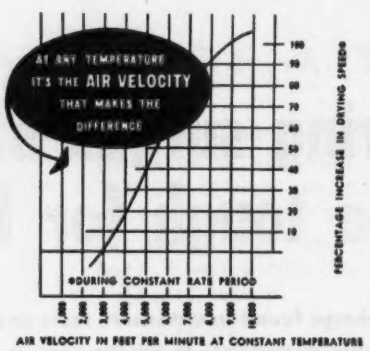
" . . . The terms unit operations and unit processes may become identified with physical operation principles and chemical process principles as the two great stems of engineering science upon which chemical engineering rests. The following lists show the main areas included in each stem:

I—Physical operations principles
- A Mechanics
  - 1 Solid bodies
  - 2 Fluids
- B Material balances
- C Energy balances; thermophysics
- D Equilibrium relationships
  - 1 Phase equilibria
  - 2 Ideal stage separations

To page 90



The creation and development of this new JETZONE particle oven revolutionizes the techniques of drying particles. Wolverine offers a new method for the heating and cooling or drying of particulate material; such as, chopped plastic, pelletized rubber, food, and chemicals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THAT MAKES THE
DIFFERENCE
PERCENTAGE INCREASE IN DRYING SPEED
DURING CONSTANT RATE PERIOD
AIR VELOCITY IN FEET PER MINUTE AT CONSTANT TEMPERATURE

This method embodies an air projection assembly which shoots high velocity air (hot, cool or dry) into the bed of material causing it to be completely aerated. All particles are in motion, but they are in regular contact with the conveyor in the fluidized state. This technique is a vast improvement over contemporary equipment and the JETZONE process reduces the treating times from 1/3 to 1/6 of conventional methods.

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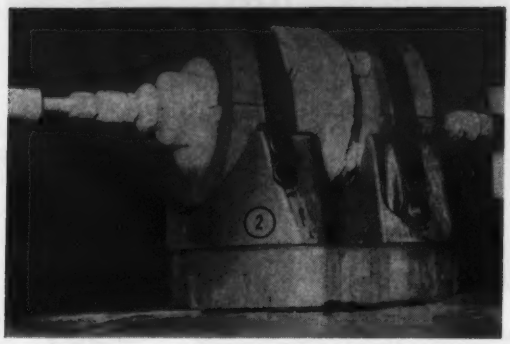
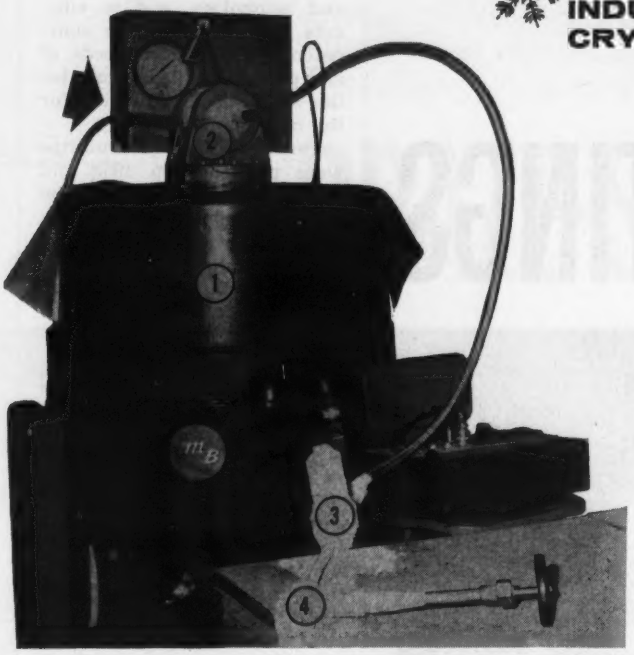




Vibration tests *at cryogenic temperatures are conducted in this MB-C25 Exciter unit (1) with test flange assembly containing the gasket mounted on top of it (2). Two-micron filter for liquid nitrogen is shown at (3) and pressure-relief valve at (4)*

Quivering surges of pressure at -322°F not too tough for filled-Teflon gaskets

Zero leakage found in extensive tests and favorable experience in missile service suggest that gaskets are suitable for equally severe cryogenic operations in chemical processing plants

By J. DAVE MOFFATT Mechanical Facilities Engineer
The Martin Company, Site Activation Division
Buckley Field, Denver, Colorado
With CP Staff

Gaskets *are available in diameters from ½" to 24"*

Problem: Gaskets used for handling liquid oxygen for propellant loading of Titan and Atlas missiles did not provide an adequate seal and had a short service life. For example, at one large installation it was readily admitted that gaskets were expected to leak to some extent. As leakage increased and became excessive, a gasket was replaced. Average service life of gaskets was only seven days' operating time.

Gaskets being used at this facility had an alloy wire center, encased in rubber. The gasket was originally developed for jet aircraft fuel lines at elevated temperatures, and is highly effective in that application. However, it was not suitable for cryogenic fluids.

Experience was also unsatisfactory with the conventional filled or impregnated fluorocarbon gaskets. Material tended to flake off or shred under the tremendous surges of pressure and temperature cycling. In some cases gasket material extruded into flow lines, or fibers migrated. Gaskets did not have required compressibility or sealing qualities.

In order to contain the gasket and prevent contamination of propellant systems, a metal retaining ring was used. However, this resulted in electrolytic and corrosive action in those systems which did not have a dry gaseous blanket pressure.

Solution: In searching for a more satisfactory gasket material for the missile service, a product known as Fluorogreen E-600® was discovered.

Fluorogreen E-600 is a homogenous mixture of Teflon®, pulverized glass and inorganic coloring materials. It is compounded in such a way as to insure a uniform density and elimination of hard or soft spots. Superior qualities found

for material in tests are due to critical blending formulas, along with close control of molding pressures and sintering temperatures. Continuous checks during production by an effective quality control organization are also responsible in large degree for capabilities of product.

Gaskets Tested at —322°F

The Fluorogreen gaskets were subjected to a series of tests in January and February 1961 at the Martin Waterton plant in Denver and the Cryogenic Laboratory of Beech Aircraft Company in Boulder, Colorado. Tests utilized liquid nitrogen, which has a boiling point of —322°F at the high elevation where the tests were conducted.

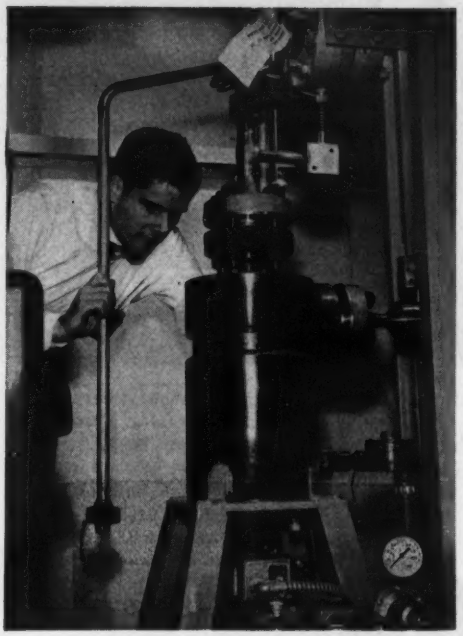
In the tests, gaskets at ambient temperature were subjected to less than 10 microns of external vacuum chamber pressure, and then an internal surge of liquid nitrogen at 125 psig and —322°F was released. When the liquid nitrogen hit the lines, a tremendous amount of expansion and contraction occurred and the entire system quivered and frosted over. Sudden surges and rapid changes in temperature and pressure constituted a very severe test for the gaskets.

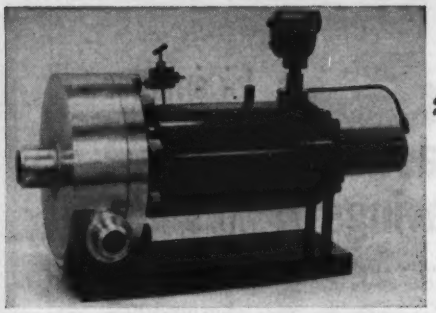
In one series of tests, the gaskets were subjected to a drastic thermal shock as temperature was reduced from 165° to —322°F by submersion of the heated gasket in a liquid nitrogen bath, along with almost simultaneous application of 400 psig pressure. The gasket maintained its sealing qualities under these conditions.

In other tests, gaskets at —322°F were held respectively at 100, 200, 300 and 400 psig for 15 minutes at each pressure. In these tests and a number of others in which gaskets were subjected to severe vibration, the gaskets had zero leakage.

Impact tests to show compatibility or sensitivity of Fluorogreen E-600 to liquid oxygen and long-term leak tests were run by Arthur D. Little Company, Cambridge, Mass.,

1





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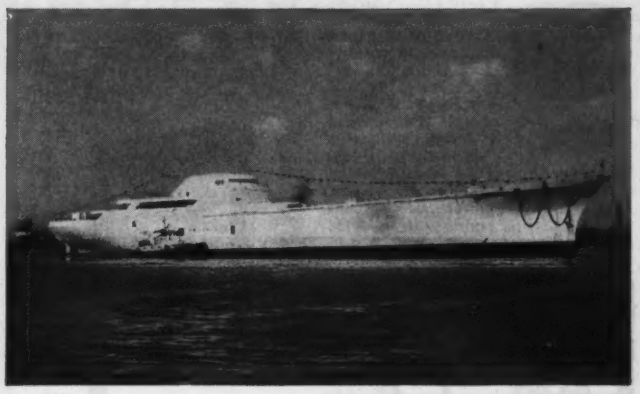
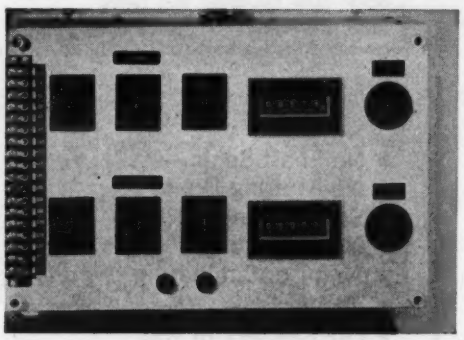


PHOTO COURTESY OF NEW YORK SHIPBUILDING CORPORATION

A PUMP IN SEARCH OF A **TOUGH** JOB



4

1 At General Electric Co.'s Hanford Atomic Products Operation, this CHEMPUMP performs at 30 gpm, 100′ TDH, 700° F, and 3000 psi line pressure. Several others circulate water at 575° F and 1700 psi.

2&3 N.S. SAVANNAH, world's first nuclear merchant ship, uses this CHEMPUMP to circulate primary coolant at 1750 psi, 520° F, 245 gpm and 110′ TDH. Other CHEMPUMPS handle radioactive waste with suspended solids and noncondensable.

4 CHEMPUMP developed this automatic controller (illustrated) and leakproof valve operator for use in a 1050° F and 1000 psi helium line. Designed in cooperation with the Darling Valve Company, it contains the helium with zero leakage and provides automatic valve positioning with an accuracy of 0.2%.

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LEAKAGE	zero (. . . in *or* out)
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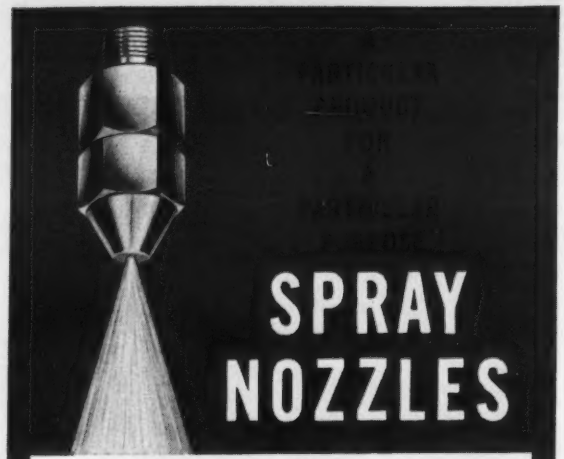

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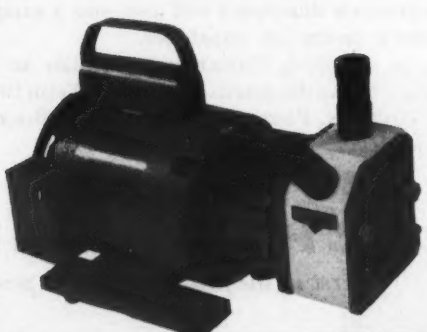

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DIVISION OF COOPER ALLOY CORPORATION
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VP100

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under the direction of R. L. Hinkley, February 13-17, 1961.

Tests showed that the gasket is LOX compatible to 210 ft-lb of impact and is suitable for flanged cryogenic pipe complexes. The material was found not to be fragile at installation or cryogenic temperatures. It remains flexible in thin sections at liquid nitrogen temperatures. Fluorogreen welds were found to retain strength at cryogenic temperatures. Fluorogreen did not flake, chip or react with metal flanges. No fiber migration occurred. Tests showed the gaskets could be re-used if the initial torque were not satisfactory.

Results: Fluorogreen E-600 is the only completely successful cryogenic gasket material discovered to date for the Atlas and Titan propellant loading systems. Experience in missile work has confirmed the tests, indicating zero leakage at the cryogenic temperatures encountered. The gaskets are giving good service and are easily cleaned.

Gaskets used in the missile propellant loading service are 3/32″ thick. They are available in diameters from ½ to 24″.

Several organizations are currently testing Fluorogreen E-600 at helium and hydrogen temperatures. Effect of radiation on material is also being studied. Future studies could lead to use of the product for expansion joints, bearings and bushings for cryogenic service.

(Fluorogreen E-600 is product of John L. Doré Co., 5406 Schuler St., Houston 7, Texas.)

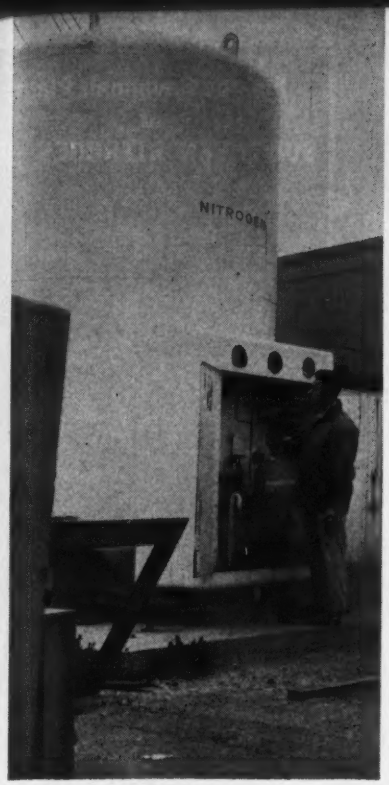
Check 5142 opposite last page.

Insulation for temperatures down to −400°F is included in comprehensive 64-page catalog which also describes insulation for moderate and high temperatures. Cat IN-244A — Johns-Manville Sales Corporation.

Check 5143 opposite last page.

Teflon piston and rider rings are topic of two page specification sheet. Units withstand temperatures from −420° to +500°F, and are ideal for liquid oxygen or nitrogen applications. "Teflon Rings" — Garlock Inc.

Check 5144 opposite last page.



Operator Angelo Cirella *gets set to start dispersing liquid nitrogen from 8240-liter cryogenic storage tank*

INDUSTRIAL CRYOGENICS

Liquid nitrogen cost slashed by $55,000 a year

Cryogenic storage tank holds vacuum for three years without maintenance

By **THEODORE W. WETT,** Associate Editor
with **ANTHONY J. MATZ,** Material Service Manager,
Argonne National Laboratory

Tony Matz (right, clarifying a phase of liquid nitrogen handling operation for CP Associate Editor Ted Wett) was present December 2, 1942, when world's first controlled-nuclear-chain reaction was achieved in makeshift laboratory under west stands of Stagg Field on University of Chicago campus. It was this group of scientists, then under direction of late Dr. Enrico Fermi, that became Argonne National Laboratory, which now represents a capital investment of $110 million. Argonne employs approximately 3750, 1900 being scientists, engineers, and supporting technicians, and 1850 administrative and managerial staff, service and clerical employees
(Photos by CP Staff)

AT Argonne National Laboratory, where liquid nitrogen is playing an increasingly important role in all phases of experimental work, a cryogenic storage tank plays a key role in returning savings of an estimated $55,000/yr. With the use of liquid nitrogen growing continuously, the annual savings could, within a year or two, reach $75,000.

Major portion of the savings accrues from the lower unit cost of liquid nitrogen (compared to 1948) made possible by bulk purchases, on a competitive bid basis. Efficient storage and distribution of the liquefied gas are implemented by a virtually maintenance-free storage and dispensing station, which was installed in 1958. Vacuum, of utmost importance on a 8240-liter, double-walled tank, has remained satisfactory for the three years the unit has been in service without re-evacuation.

Use of liquid nitrogen at Argonne virtually blankets all segments of operations from chemistry and fuels technology to chemical engineering and reactor operations. Current consumption runs approximately 11,600 liters/week, requiring a bulk delivery three to four times each week. A 40-50% increase in the rate of use is expected within the next year.

How Liquid Nitrogen Is Used At Argonne

At Argonne, liquid nitrogen is employed as a cold trap in high vacuum systems to remove solid particles, liquids, vapors or gases. These include oil vapors which have escaped from diffusion pumps and other condensable gases that may be present in a vacuum system. In the Physics Division, vapors could change the characteristics of high voltage electrodes in Van de Graff accelerator and electrostatic analyzers and thereby seriously affect test results and the operating range.

Liquid nitrogen is used to freeze and transfer other gases, such as carbon dioxide, xenon, argon, krypton; and liquids such as methane, ethylene, isopropane and ethyl ether. It is used to condense materials which only become liquid or solid at very low temperatures. Plutonium hexafluoride is condensed in liquid nitrogen traps to increase ease of handling.

In fluorination experiments with plutonium dioxide and uranium-plutonium dioxides, liquid nitrogen is utilized to condense any volatile matter which is passed through activated alumina chemical traps. This cleanup procedure is necessary before gases can be passed into vacuum pumps mounted outside plutonium glove boxes. (See CHEMICAL PROCESSING, August 1959, page 63.)

Liquid nitrogen is also used in blood preservation; biological research; preservation of cancer cells; storage of bacteria cultures; preservation of enzymes, hormones and proteins; and to maintain cold storage of metallurgical samples. Machinists use liquid nitrogen for shrink fitting. Occasionally, rubber parts are frozen for precision machining.

Until 1948, the Argonne Na-

To next page

DIAL IN ON GREATER TEMPERATURE CONTROL ACCURACY!

"Pin-point" accuracy is at your fingertips with West's new tubeless, solid-state digital set point controllers. By adjusting the 3-digit, 1000-unit dial, the control point can be set in increments (depending on range) as small as ½°. Null balance circuit provides exceptional sensitivity . . . closer than ¼° with most thermocouples.

Calibration is not affected by leadwire length. Continuous cold junction compensation is provided electrically. Repeatability, linearity and resolution are excellent.

These compact units may be panel or surface-mounted. Available in on-off, proportioning and stepless (saturable core reactor) control modes . . . one, two or three ranges can be provided. For full details, write for Bulletin JY.

NEW DIGITAL SET POINT CONTROLLERS ...by WEST

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FACTORY AND GENERAL OFFICES
4357E W. MONTROSE, CHICAGO 41, ILL.
WEST INSTRUMENT, LTD.
52 Regent St. Brighton 1, Sussex

Check 5145 opposite last page.

Liquid nitrogen

From preceding page

tional Laboratory obtained liquid nitrogen from the University of Chicago by truck. A usual load/day was 10 to 15 Dewar flasks of 25-liter capacity. In 1948, a vendor-owned-and-maintained tank was installed and remained in service until 1958 when the present facility was purchased. Liquid nitrogen is now procured on a competitive bid basis with a contract being awarded for a one-year period.

$27,000 Saved First Year

During the first year alone, a saving of $27,000 was realized. This was more than the cost of the complete installation.

Liquid nitrogen is still delivered to using areas in Dewar flasks ranging in size from 15 to 200 liters. At about 8:30 each morning, a truck driver begins a round of picking up empty flasks. He delivers them to a dispensing area, where they are filled, and returns the flasks in the afternoon. An efficient valve-and-fill-tube setup (Monel and 316 stainless), designed and fabricated at Argonne, can fill up to 50 liters in about four minutes. A 100-liter flask takes nine minutes; a 200-liter flask, 15 minutes.

Empty Dewar flasks are delivered to nitrogen filling station at Argonne National Laboratory. Cryogenic storage facility saves $55,000/yr

Fabrication of Cryogenic Storage Vessel

The cryogenic storage vessel consists of an inner tank of 304 stainless enclosed in a

For the Savannah Plant of SOUTHERN NITROGEN CO.

"...excellent trouble-free service" against SURGE PRESSURES

Handling hot potassium carbonate requires safeguarding pumps and piping systems against dangerous pressure surges. Eight Williams-Hager Silent Check Valves—similar to the one shown at right—guard Southern Nitrogen's Savannah Plant by operating *instantly* when flow reversal starts or when flow is zero.

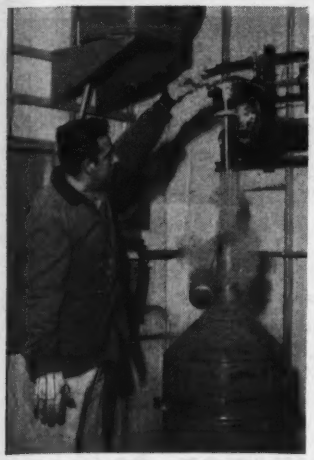
Write for Bulletins: #654 on Valves; #851 on Cause, Effect and Control of Water Hammer; #659 on Pressure Loss Tests.

WILLIAMS • HAGER
Silent
Check Valves

The Williams Gauge Company, Inc.
146 Stanwix Street • 2 Gateway Center
Pittsburgh 22, Pa.
Our 75th Year • 1886-1961

Check 5146 opposite last page.

carbon steel vacuum shell. All plumbing, for filling and in the control-cabinet area up to the dispensing valve, is Type K copper tubing, with valves and controls designed for cryogenic service. Welding on the stainless steel inner vessel and



Filling 100-liter Dewar of liquid nitrogen requires about nine minutes

shell was done by the automatic submerged-arc method.

Stainless steel tubing was used in the vacuum space for all inner connecting liquid and gas lines. It was joined to the inner vessel and shell by heli-arc welding. The joint between stainless and copper is a silver-solder connection.

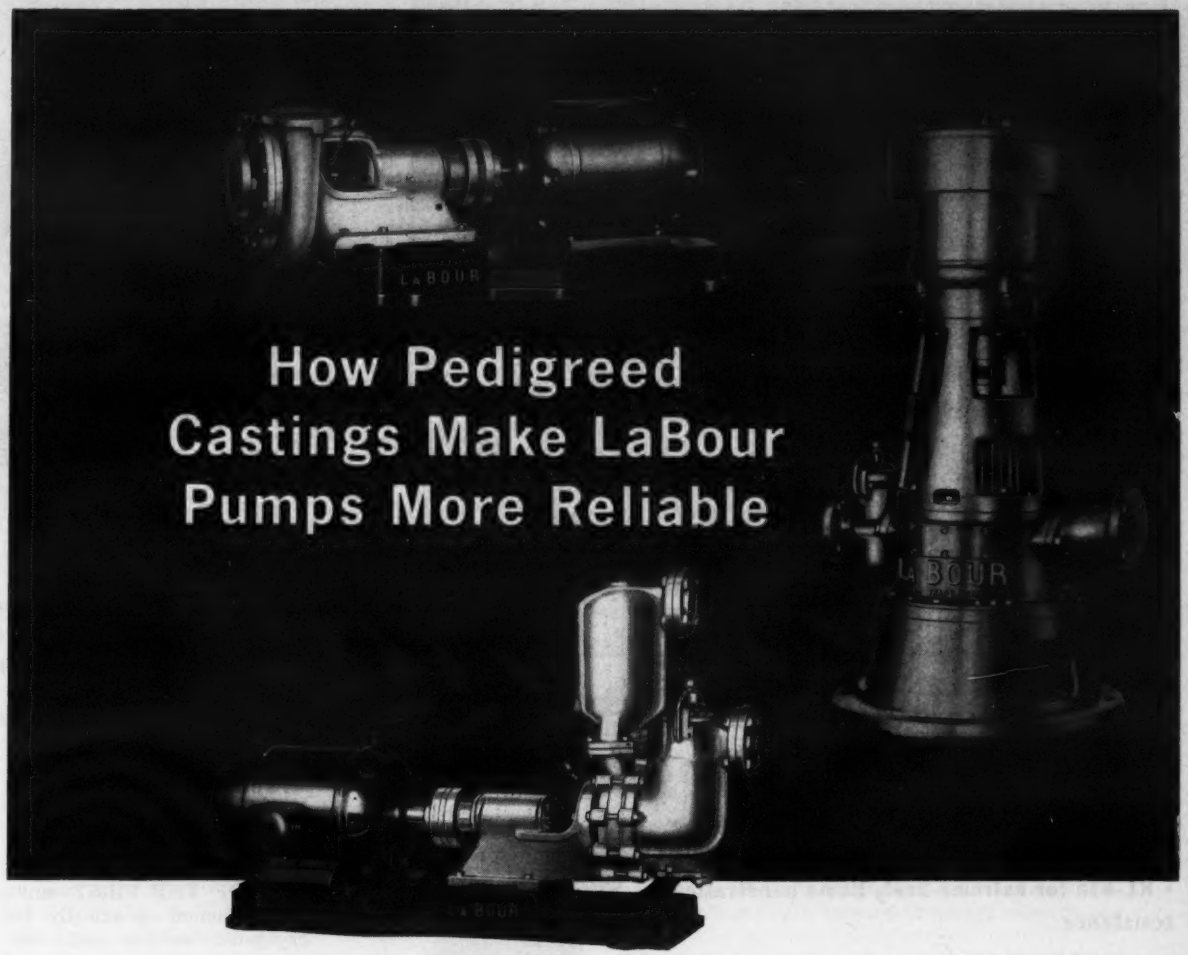
After being carefully tested with a helium mass spectrometer leak detector, the unit was evacuated and insulated with perlite. Vacuum integrity is guaranteed for a one-year period. The manufacturer believes it should continue to remain satisfactory for an extended period of time, barring any unauthorized valve operation.

(Cryogenic storage facility is product of Ryan Industries, Inc., 888 East 70th St., Cleveland 3, Ohio.)

Check 5147 opposite last page.

Solenoid valve, available in either brass or stainless steel with Teflon discs and gaskets, for handling cryogenic liquids and gases is covered in two-page Form V5126 —Automatic Switch Co.

Check 5148 opposite last page.



For nearly 30 years LaBour has carefully analyzed and recorded every heat of corrosion resistant alloys cast in its foundries and has permanently identified each casting with its heat.

Because LaBour knows the exact metallurgical structure of each individual casting, customers' requirements can be met with the greatest accuracy. Moveover, even small variations in analysis and casting conditions can be checked against field performance years later, so LaBour has acquired a wealth of information leading to improved alloys and foundry techniques.

"Pedigreed" castings provide one of the many reasons why you can depend on LaBour pumps in all kinds of chemical service! Write for full information.

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LABOUR

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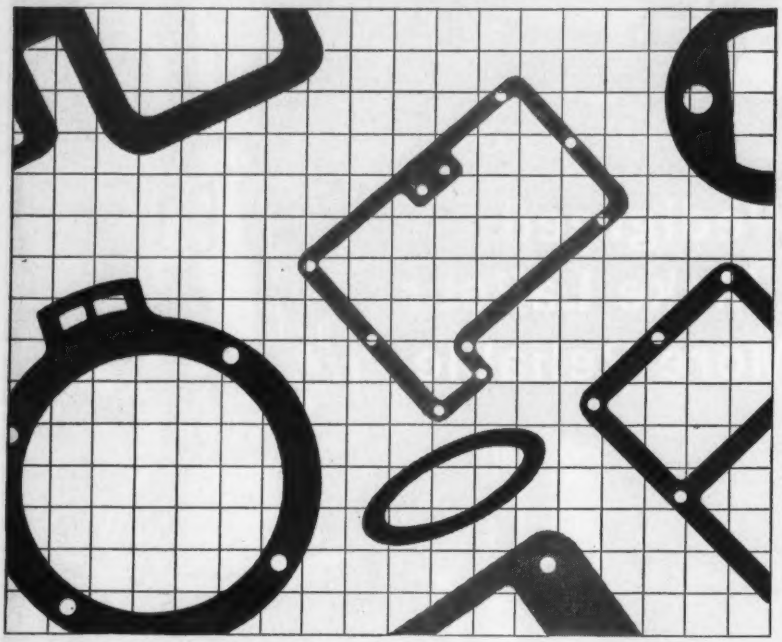
WHITE PIGEON, MICH. • LONDON, ENGLAND

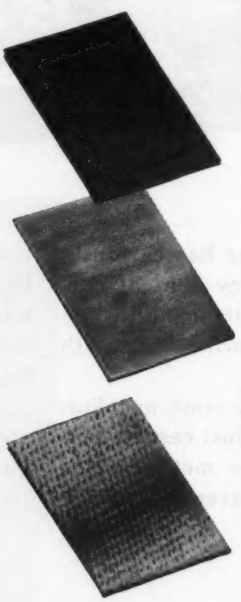
Check 5149 opposite last page.

R/M CAPABILITY DOES IT AGAIN!

Develops these outstanding gasket materials



FLUOROBESTOS for LOX and cryogenic service
• A-56 for flange temperatures to 1100° F
• RL-638 for extreme heat, flame penetration resistance



R/M FLUOROBESTOS* is a high grade, long-fiber asbestos unwoven sheet thoroughly impregnated with Teflon.† It has the same sealing and physical characteristics as compressed asbestos sheet, with the added benefits of Teflon. Deformation under load at 500°F (2000 psi) is only 0.1%.

R/M No. A-56 is a compressed asbestos sheet made from spinning-grade long asbestos fiber and a nonreverting compound binder. Average tensile strength of 8000 psi. The only compressed asbestos sheet made commercially in thickness of .008 in. ±.001 in. It has high heat resistance—is withstanding flange temperatures of 900 to 1100°F where internal temperatures are as high as 1400°F.

R/M No. RL-638 is a wire-inserted, woven asbestos fabric coated with neoprene compound and aluminum finish. It is ideal for use as seals against extreme heat and where high-temperature (2000°F) flame penetration resistance is required. Its light weight is a plus value. Meets FAA Specification CAR-04b-075 (a) for Fireproof Materials FAA Release #259, Section 1, Part B1.

*Registered trademark for R/M reinforced asbestos Teflon sheet.
†Registered trademark for Du Pont fluorocarbon resins.

Write for our Mechanical Packing and Gasket Materials Catalog P-100. And remember, when ordering gaskets from your cutter specify R/M materials. Sheets are available from your authorized R/M distributor.

RAYBESTOS-MANHATTAN, INC.
R/M PACKINGS
PACKING DIVISION, PASSAIC, N.J.
MECHANICAL PACKINGS AND GASKET MATERIALS

Check 5150 opposite last page.

Heat exchanger is located on underside of tankcar. Note frosting in center of tankcar and on exchanger from the supercold

Double-wall, liquid oxygen tankcars, insulated with perlite under vacuum, are equipped with specially developed finned-copper-tube pressurizing units, which —

Unload liquid oxygen faster

TWO OF THE FIRST tankcars designed specifically for cryogenic service were recently placed in service by Canadian Liquid Air Company, Limited to transport liquid oxygen. They are equipped with recently-developed pressure-building coils which permit considerably faster unloading of product. This cuts turnaround time and product losses.

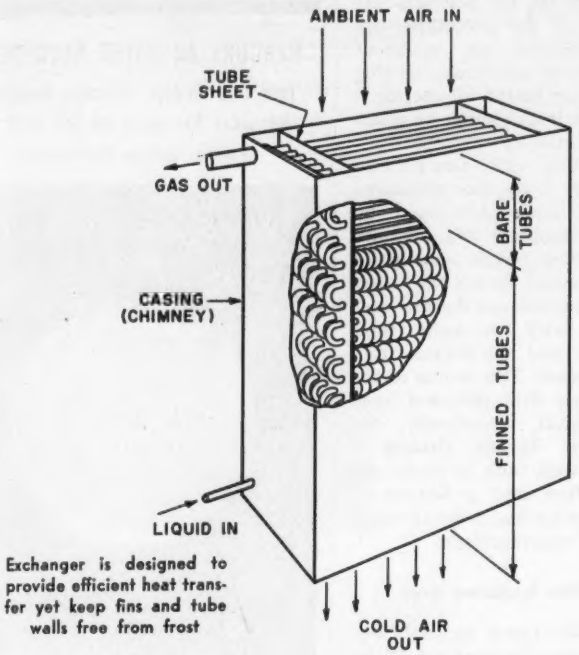
To move cryogenic liquids from transport or storage tanks, a small amount of liquid is vaporized. This vapor is returned to the tank above the liquid level, building up pressure in the tank and thereby forcing the main mass of liquid out through the discharge pipe. Conventional heat exchangers used for this service are satisfactory but have low flow rates. Initial tests of the recently-developed exchanger showed capacities in excess of expectations.

Copper was selected for the exchangers because it can withstand the −297°F temperature of liquid oxygen and also provide a good heat transfer surface.

Heat transfer from a gas to a liquid would usually indicate the use of finned tubes. However, water vapor in the air presented a problem. Snow formed at the supercold temperature would quickly bridge fins, restricting flow of air and insulating the fins. A decision was made to precool the air in order to eliminate most of the moisture before its passing over the finned tubes.

A large temperature difference between ambient air and liquid oxygen made film boiling inevitable. Many users of cryogenic liquids use the vapor layer resulting from film boiling as insulation for their cryogenic pipe lines. It was hoped that the air could be cooled to a point where the difference between its temperature and that of the liquid oxygen would result in nucleate boiling. This would increase the heat transfer coefficient substantially.

By cooling the air to lower than usual temperatures, the difference between its density and that of the ambient air was increased. This gave higher velocities by natural con-



Exchanger is designed to provide efficient heat transfer yet keep fins and tube walls free from frost

vection, higher air film coefficients and higher overall coefficients. The higher velocity also helped to keep the tubes swept free of frost.

To keep the dry, cold air in, and warm, humid air out of the finned tubes, the heat exchanger was enclosed in a casing. The casing serves as a reverse chimney to add materially to the rate of convetion flow over the tubes.

Studies resulted in the design of a heat exchanger of the type shown in the accompanying figure. Liquid oxygen drains from the tank to the bottom of the heat exchanger.

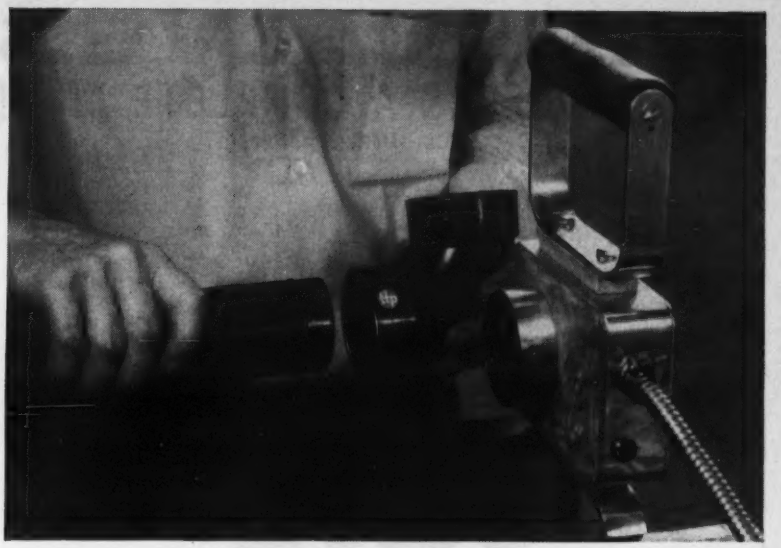
It is heated, boils, and is superheated as it passes through the finned tubes. In the bare-tube section, gas-to-gas heat transfer exists and finned tubes are not indicated.

The warm, moist air enters the top of the chimney. Most of the moisture is deposited on the bare tubes. These are spaced so that ice buildup will not seriously restrict flow. The air leaving the bare tube section is cool and dry. It then passes through the finned-tube section. Little ice is deposited in this section. Air off the bottom is quite cold and dry.

Design calculations were based on an inlet air temperature of 70°F and a relative humidity of 50%. The calculated temperature of the air leaving the coil was −110°F, saturated. With air entering at 17°F and 57% relative humidity, the measured temperature of the air leaving was −133°F.

During preliminary laboratory tests it was noticed that when ambient air was passed over a finned tube carrying liquid nitrogen, frost was deposited on the edges of the fins. The sides of the fins and the tube wall remained free of frost. During the test of the prototype, small frost deposits were found on the edges and sides of the fins and on the tube wall. These deposits were light and the color of the copper was apparent through them.

Of considerable interest was the steady state operation. It had been expected that the pressure-building coil should operate continuously until the tank to which it was attached was empty. It was thought



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THERMO-SEAL

Drainage Pipe and Fittings

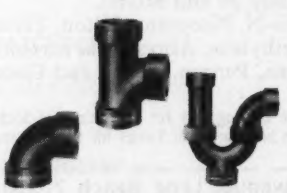
The cost saving advantages of thermoplastic piping for industrial, hospital and laboratory waste disposal are now broadened by recent developments of Tube Turns Plastics.

✓ A fully integrated line of **THERMO-SEAL*** polyethylene and polypropylene drainage pipe *and* fittings . . . *one-source* assurance of close control over dimensional tolerances and chemical compatibility necessary for accurate fit-up and completely homogeneous bonds.

✓ An advanced technique of thermal bonding made possible by the **THERMO-SEAL** heat tool . . . a simple, easy-to-learn method that produces permanently leakproof joints that are stronger than the pipe itself—in a matter of *seconds!*

THERMO-SEAL polyethylene and polypropylene drainage piping have been incorporated in the plumbing codes of many states and municipalities and written into the standards of numerous large companies. Thus, the engineer may now safely specify these low-cost corrosion resistant materials for waste disposal systems heretofore regarded as outside their scope, and realize attractive savings in material costs, labor charges and replacement expense.

THERMO-SEAL pipe and fittings are stocked by and sold through authorized Tube Turns Plastics Distributors in all principal cities. Sizes 1½" thru 3" are available. Fittings are furnished with socket, male thread, spigot, internal pipe thread or union ends. The full range of types include ¼-bends, ⅛-bends, straight and sanitary tees, y-branches, increasers, couplings, adaptors, p-traps, drum traps, etc. **THERMO-SEAL** heat tools are available in two models: for sizes ½" thru 2½" and for 3" thru 6".



Ask for Bulletin TTP218-HI42.

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Tube Turns Plastics also manufactures a complete line of UPVC (unplasticized polyvinyl chloride) drainage fittings for threaded or solvent cemented piping.

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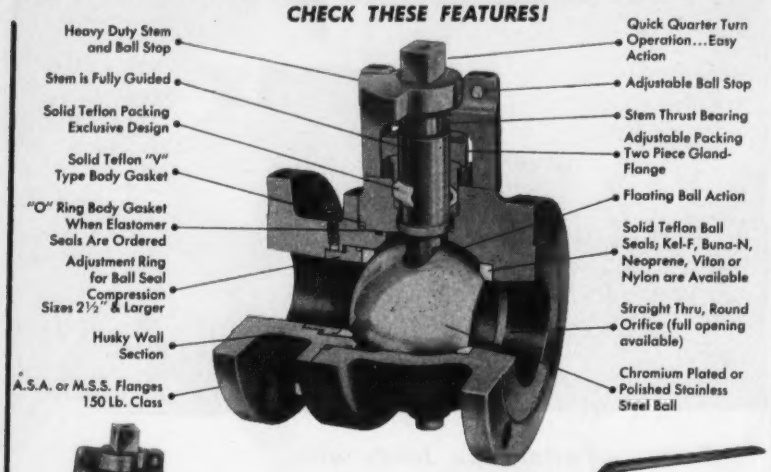
Check 5151 opposite last page.

BALL VALVES

PACIFIC OFFERS A COMPLETE LINE!

CHECK THESE FEATURES!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Floating Ball Action
Solid Teflon Ball Seals; Kel-F, Buna-N, Neoprene, Viton or Nylon are Available
Straight Thru, Round Orifice (full opening available)
Chromium Plated or Polished Stainless Steel Ball

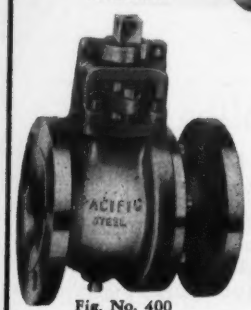

Fig. No. 400
Flanged Ends
150 lb. Series
Sizes – 2½" thru 14"

Fig. No. 225
Screwed Ends
Up to 2500 Lbs.
Sizes – ¼" thru 2"

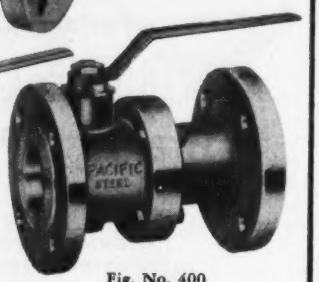

Fig. No. 400
Flanged Ends
150 lb. Series
Sizes – ½" thru 2"

Pacific's Complete Line of Ball Valves is offered in an unusually wide range of Corrosion Resistant materials...Materials to cope with nearly every corrosive condition!

Available *standard* models and sizes: Screwed Ends, for pressures up to 2500 lbs., ¼" to 2"; Flanged Ends, (150 lb. Series) – ½" thru 14"; Flanged Ends, (300 lb. Series) – ½" thru 10"; Flanged Ends, (150 lb. Series) with 300 lb. line flanges and 150 lb. face to face dimension – ½" to 14"; Screwed Ends, 3-Way Ball Valves, ½" to 2"; Flanged Ends, 3-Way Ball Valve, (150 lb. Series) – ½" to 8"; Flanged Ends, 3-Way (150 lb. Series) with 300 lb. line flanges – ½" to 6"; High Pressure Ball Valves, up to 2500 lbs. – ¼" to 2"...up to 6000 lbs. – ⅛" to 1"; Socket Welding End Valves, Ratchet Operated Valves, Spring-Return Valves. Valves for block & bleed service, fire-safe Valves and many more.

Available *standard* body materials: Cast Iron, Ductile Iron, Bronze, Aluminum. Carbon Steel, CF8, CF8M, Alloy 20 and Monel.

Available *standard* seal materials: Buna-N, Neoprene, Viton, Teflon, Kel-F, Nylon, Delrin and Irradiated Polyethylene. Also special corrosion resisting coating materials such as Kanigen, Penton, Teflon and Electro-Film, can be supplied.

Send today for a representative or a new 64 page catalog. Ask for Pacific's new Socket-Welding End Brochure BVWE-61, and also the new sales brochure Ball Valves for High Pressure Gas – BV/HP1.

PACIFIC VALVES, INC., 3201 Walnut Avenue, Long Beach 7, Calif.

Gentlemen: Please have a representative call upon me with your new ball valve catalog.

NEW 64 PAGE BALL VALVE CATALOG

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Check 5152 opposite last page.

CRYOGENICS

that if the period of operation was extended, the ice build-up would continue and eventually choke off the air flow. During the test of the prototype, the unit reached an apparent equilibrium condition. During some four hours of operation after the initial icing, no additional build-up occurred.

The two HD tankcars equipped with the pressure-building coils, developed by Graver Tanks & Mfg. Co., are called hotdog-type because of the rounded heads on each end. Tankcars are double-wall vessels, with the inside tank stainless and the outside tank carbon steel. This is one of the first times that tankcars have been built specifically for cryogenic liquids. Usually a double-wall tank is made and then fitted into a boxcar to avoid its having to be fastened to the undercarriage.

Perlite Insulation Used

Annular space in each liquid oxygen tankcar was filled with 1600 cu ft (4800 lb) of Ryolex perlite, the insulation considered to be the most satisfactory for this application. Annular space is maintained under vacuum.

The cryogenic tankcars utilizing the special heat exchangers would be suitable for transporting other low-temperature fluids besides liquid oxygen. Also, the same design could be used for cryogenic storage tanks.

(Tanks equipped with special heat exchangers were designed and built by Graver Tank & Mfg. Co., division — Union Tank Car Company, 35 E. Wacker Drive, Chicago, Ill., for use on the HD design tankcars of its parent, Union Tank Car Company.)

Check 5153 opposite last page.

(Heat exchangers were made by Griscom-Russell Company, Massillon, Ohio.)

Check 5154 opposite last page.

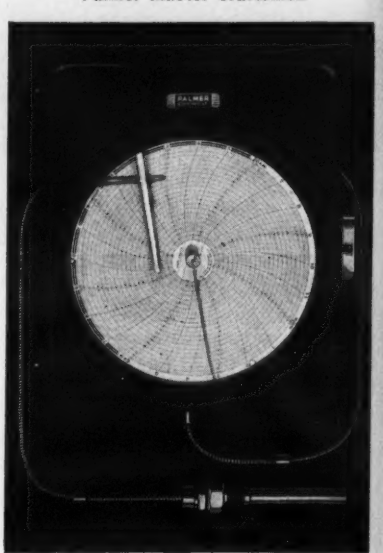
(Perlite insulation was furnished by Silbrico Corporation, 5901 West 66th St., Chicago, Illinois.)

Check 5155 opposite last page.

PALMER

MERCURY ACTUATED RECORDERS

Into this modern Mercury Actuated Recorder has gone all the skill of Palmer Master Craftsmen



Readings are clearer, smoother and more precise than ever thought possible. In fact readings are so amazingly improved that maintenance is never needed under normal uses.

Recording Thermometers feature twelve inch die-cast aluminum case with black wrinkle or white satin finish. Single or multiple pen construction. Electric or spring wound clock, 24 hour or 7 Day Revolution. Flexible Armor and bulb of stainless steel. Ranges: —40 to 1000°F. or Equivalent in °C.

Send for Bulletin No. 45
Consult your Classified Directory

PALMER

PALMER THERMOMETERS, INC.
Mfrs. of Industrial Laboratory, Recording and Dial Thermometers
Cincinnati 12, Ohio

Check 5156 opposite last page.

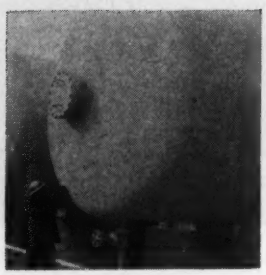
CHEMICAL PROCESSING

8TH ANNUAL FEATURE

CORROSION CONTROL

BATTLING CORROSION — Beginning on the next page you will find CHEMICAL PROCESSING'S 38-page section dealing with this vitally important subject. This group of articles — specially developed for this issue — contain the latest information about corrosion control techniques and developments.

1



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6

1 "RUST IN PEACE" —

Exclusive CP survey reveals that few chemical companies have formal corrosion control programs 40

2 THINGS TO KNOW ABOUT MAINTENANCE COATINGS —

A round-up of 11 types of major coatings; what each can and cannot do 54

3 CORROSION RESISTANCE OF 1200°F +ALLOYS —

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4 GETTING MOST MILEAGE OUT OF GLASS-LINED UNITS —

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Used to filter tough corrosives, units pay for themselves every year of operation 60

6 WATER PIPE "WATCHDOG" —

Five dollar device nips corrosion costs 62

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*". . . **A corrosion** engineer should be able to effect annual savings amounting to 10 times his own salary, if he is any good." This photo shows Mike Rogers, corrosion specialist at Union Carbide Corporation, installing a field corrosion rack in an absorber*

***To cut down** on corrosion losses, the chemical industry needs more men like these two experts, Walter A. Szymanski (right) and Harvey Jacobs, inspecting chemical reactor for corrosion at Hooker Chemical Corporation's Niagara Falls plant*

'Rust in Peace' . . .

Exclusive CP survey reveals that few chemical companies have full-time corrosion engineers or formal corrosion control programs in effect in their plants. With millions of dollars at stake each year, is your company doing all it should to stem the tide against this deadly foe?

TED F. MEINHOLD, Associate Editor

SIX BILLION DOLLARS a year — that's what corrosion is costing American industry today. If you are working for one of the major chemical companies, its share probably averages somewhere between two and three million dollars. No matter how you slice it, that's quite a chunk of change!

There is a further fear that this figure may even grow beyond its present terrifying proportions. Instead of getting easier, indications are that corrosion control seems to be becoming more difficult. New chemical processes, higher temperatures and pressures are making the job increasingly complicated.

What is the chemical industry doing about all this? How are companies organized to fight this enemy that constantly keeps gnawing away at vital equipment? What kind of men are being thrown into the battle?

Ten Questions Asked in Survey

To get the answers, CHEMICAL PROCESSING surveyed 20 leading chemical firms. Our query consisted of the following 10 basic questions:

1) Does your company have a formal corrosion control program? If so, briefly explain.

2) Do each of your plants have a corrosion engineer? Full time? Part time? How many men are used in this capacity (total for all plants)?

3) If corrosion engineers are used, what title do they have?

4) Are they college graduates? Do they have formal training in corrosion control?

5) How much authority does the corrosion engineer have? Whom does he report to? Is this a satisfactory arrangement?

6) Who administers corrosion control programs?

7) Do you feel that your present corrosion control organization is adequate? If not, please explain. What suggestions do you have for improving its efficiency?

8) What are the responsibilities of the department or section handling corrosion contol?

9) Does your company use outside consultants for corrosion control work? How often?

10) Can you estimate approximate annual savings resulting from corrosion control work in your plants? Can you cite specific projects and what savings occurred?

Of the 20 companies contacted, 15 — representing more than 250 individual plants — volunteered specific information with varying degrees of detail. Two firms begged to be excused from the survey. Three companies failed to answer our correspondence.

Is There Complacency?

If we were to judge the industry on the overall results of our survey, we would be forced to this conclusion: Chemical companies are not making a whole-hearted effort to control corrosion in their plants. Only seven of the 15 firms reported that they had a formal, *full-time* corrosion control program in effect.

In the majority of the cases, the responsibility is still only a part-time job . . . an extra duty assigned to some other group such as the maintenance, engineering or manufacturing department. The men having corrosion control responsibility in these groups are certainly well qualified and capable, but the fact remains that their duties are divided and that they cannot devote full time to solving corrosion problems.

Frankly, our findings came as no surprise to us. We have had evidence of the existing situation for a number of years. We are not alone in our beliefs either. Last year,

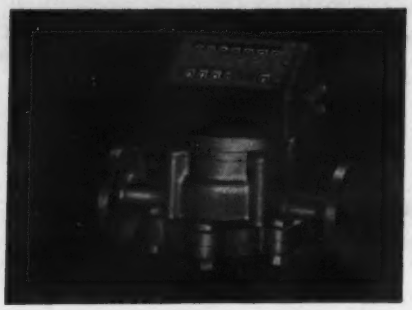
To next page

The Enemy That Gnaws

. . . that's how one company recently described corrosion. That's exactly what it does, too. It eats away at equipment and profits. With plant investment costs continually on the rise and tougher processing conditions in the making, equipment failures and process shutdowns are becoming increasingly more expensive and cannot be tolerated.

Yet, there is evidence that many chemical companies are not going all out to fight this deadly foe. The accompanying story gives an up-to-date report on the status of corrosion control in the chemical processing industries today.

NIAGARA METERS



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Whatever liquids you use in plant operations — *from Water to Solvents to Sulfuric Acid* — chances are there's a NIAGARA Meter specially designed to measure and control the flow . . . safely . . . accurately . . . with savings to you in time, material and labor.

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Leading chemical companies use NIAGARA meters in processing operations to measure and control flow of liquids. Metering assures uniform quality, provides inventory controls, speeds operations and permits safe handling of hazardous liquids.

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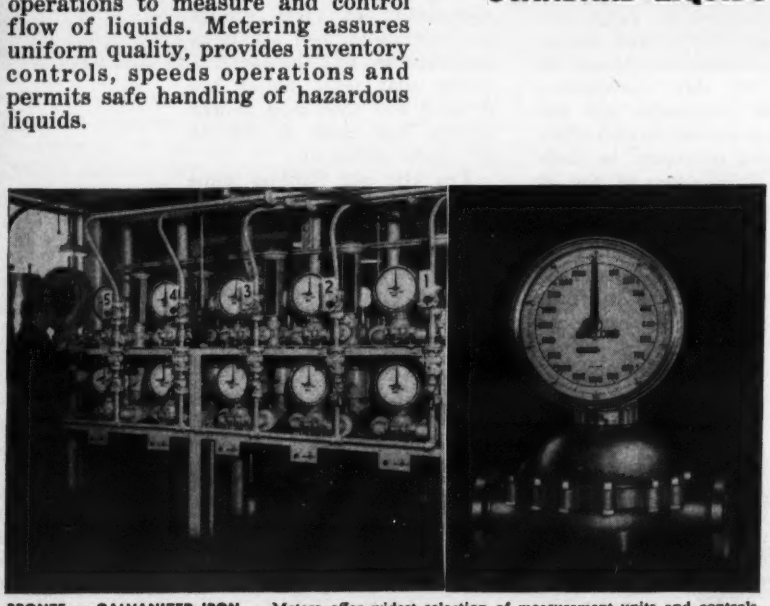

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SALES REPRESENTATIVES THROUGHOUT THE NATION

Check 5157 opposite last page.

George E. Best, 1960 president of the National Association of Corrosion Engineers, made this statement in the July issue of CHEMICAL PROCESSING:

"The science of corrosion control is making noteworthy progress but management of corrosion is sadly lacking in many companies. Costly failures occur because the corrosion engineer has insufficient status in the companies concerned. Often a plant either has no corrosion engineer at all or he is relegated to a dusty corner. In some plants he is merely an adjunct to the maintenance department."

Proof of the latter is borne out by the following typical answers to our question, *who administers corrosion control programs?*: "Corrosion problems are considered to be a part of everyday engineering and operating responsibility." "Corrosion control is a maintenance function and is normally administered by the maintenance manager . . . "

Another past president of NACE, Frank L. LaQue, vice president, The International Nickel Company, made similar observations a few years ago. His words still have a ring of truth. Here is what he said in the July 1956 issue of CHEMICAL PROCESSING:

"There aren't enough of them (corrosion engineers) on the staffs of companies who have corrosion problems — including many of the chemical and process industries where the economical solution of these problems frequently represents the difference between success or failure of a new process or product."

Corrosion Engineer . . . How Much Is He Worth?

According to one of the companies surveyed, a corrosion engineer should be able to effect annual savings amounting to 10 times his own salary, if he is any good." This same firm, which claims it has 45 individuals (total for all plants) working on corrosion problems on either a full- or part-time basis, believes that their men are *better* than good!

Another company well staffed with full-time corrosion experts expressed their value firmly but a bit more conservatively: " . . . We can confidently state that there is a savings resulting from each project studied by corrosion control personnel."

How Much Authority?

In answer to the question, how much authority does the corrosion engineer have, practically all companies admitted that his authority was limited. Such persons, they admitted, could only advise and recommend. Some firms were quite vague in their answers, but none unfortunately, said that corrosion personnel have direct and final authority to make changes. However, most of the companies felt that the advisory status was working out satisfactorily.

In our opinion, the company that came closest to granting direct authority to its corrosion engineers was the one that made this statement: "In most cases, his recommendations are accepted with minimum of questions." This same firm admitted that not all of its plants had the services of a full-time corrosion specialist and believed that these plants could benefit significantly by adding such men.

Training, Titles Not Uniform

We found that training and titles vary. For the most part, personnel engaged in corrosion control work are technically-trained, college graduates. Formal corrosion control education consists usually of university or society short courses and experience. Titles include: corrosion engineer, materials engineer, corrosion metallurgist, inspection engineer, maintenance engineer and coating engineer. The first two were most frequently listed.

Central Groups Popular

Practically all of the companies reported that a considerable amount of their corrosion control work was done by a central engineering or similar group. In many cases this is an informal program with personnel cooperating with the manufacturing or

other departments as specific problems come up. Individual plants try to cope with their own problems. If assistance is needed, they ask for it.

Many firms felt that although the arrangments was not the best, it was adequate for the time being.

Just about everything that smacks of corrosion is tackled by the central group. This includes metal corrosion, protective coatings, cathodic protection, corrosion inhibitors, standards and specifications, and inspection.

The companies admit that the arrangement is not the best. As the firms continue to grow, it is expected that there will be a need for more personnel who will specialize in particular areas and more defined corrosion procedures.

As for consultants, in general, companies seem to be reluctant to call for outside corrosion control help. This is done only on a "as a last resort" basis.

Summing up, we can say this: Progress is being made in corrosion control organization. However, operating management still seems to be reluctant to "go all the way." The programs deserve much more time, money and emphasis than they are now getting. As long as this battle is only being fought on a part-time basis, it will never be won. ■

▸ A NEW SOLUTIONS ARTICLE

Halt Cl_2 pipe corrosion with easy-to-apply PVC tape

Fumes, vapors do not affect wrap-on coating

Problem: Pipes carrying liquid chlorine from storage tanks to vaporizer lasted only six months to two years at an upper New York state chemical plant. The pipe was constantly being subjected to corrosive fumes, vapors and electrolysis. Chlorine was being transferred at 80 psi.

Solution: Pipe was wrapped with pressure-sensitive adhesive polyvinyl tape. Product is simple to apply, requiring no complicated equipment, heat or open flame.

The PVC tape is tough, conforms with irregular surfaces, has high insulation resistance, good adhesion, chemical resistance, wide temperature operating range, resistance to bacteria and fungus and long term stability.

Pressure-sensitive PVC tape provides good corrosion protection to pipe. Equipment for applying tape is not necessary, but when used, is simple to operate and is available on a rental basis

It is always ready for use, requiring no mixing, stirring or advance preparation, other than cleaning of the surface which it is to protect.

Results: The PVC tape has extended indefinitely the life of the chlorine pipes. The corrosive fumes and vapor no longer have any effect on the pipe which shows no sign of corrosion.

(Further information about Scotchrap-brand pipe protection tape may be obtained from Minnesota Mining and Manufacturing Co., 900 Bush Avenue, St. Paul 6, Minn.)

Check 5158 opposite last page.

Two new color films, 16-mm with sound, depict advantages of Pyrex-brand glass drainline. The first, 20 minutes long, discusses installation and plumbing techniques and gives brief demonstration of cutting and beading.

Second film deals with cutting and beading operation only. Its running time is 10 minutes. Films are available for showing at no charge. Further information may be obtained by writing to Advertising and Sales Promotion Department, Corning Glass Works, Corning, New York.

That's right, mister! One of the simplest, most economical ways to cut downtime and maintenance is to use Kuhns Ductile Iron Pipe Fittings.

They have the strength and shock resistance of carbon cast steel, the resistance to rusting and corrosion of alloyed cast iron. Vibration and thermal shock are worries of the past when you put in "K" ductile iron fittings which have been pressure rated by Underwriters' Laboratories, Inc. The advantages of increased safety, lower operating costs and lower maintenance add up to more profits for you. No wonder the swing is toward "K" ductile iron fittings (unlined or lined) and components. Kuhns also supplies a complete line of cast and malleable iron fittings. Ask for complete details.

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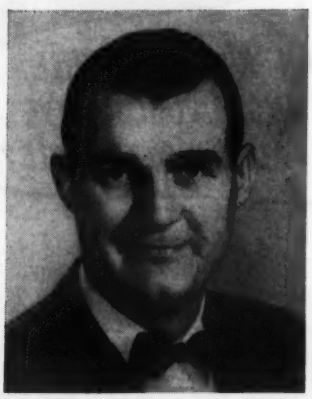
1800 McCALL STREET • DAYTON, OHIO
Cast, ductile and malleable iron fittings

Check 5159 opposite last page.

Glass-lined reactors, vessels and towers have become workhorses in the chemical processing industries. Here are some hints and suggestions on . . .

How to get the most mileage out of glass-lined equipment

By D. B. JOHNSON, Director of Technical Services
Glascote Products, Inc.
Subsidiary of A. O. Smith Corporation
Cleveland, Ohio



About the Author

DUDLEY B. JOHNSON is director of technical services for Glascote Products, Inc., a subsidiary of A. O. Smith Corporation, a post he has held since 1958. A graduate of the University of Illinois, Mr. Johnson received his B.S. degree in Ceramic Engineering in 1950. He joined A. O. Smith in 1951. After a two-year tour of duty with the U. S. Army and employment with Clevite Electronic Components during 1957-1958, Mr. Johnsen rejoined Glascote in 1958 with his present title.

SOMETIME in their career, most process engineers must make a decision as to whether they should use glass-lined equipment in their plant. Often they are hesitant . . . for the word "glass" carries the connotation that the units may be easily damaged.

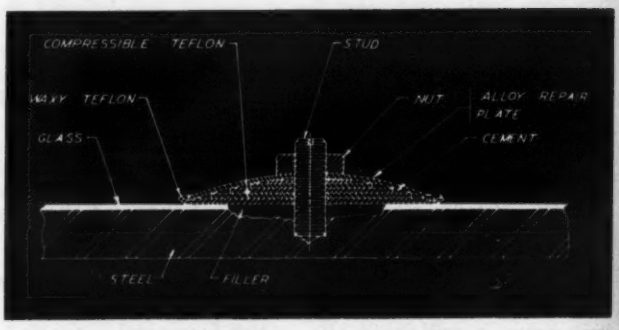
However, this is far from being true in the case of glass-lined equipment. With proper understanding of its limitations and handling, the fine corrosion resistance, ease-of-cleaning and other key benefits inherent in this kind of equipment can be taken advantage of for many years.

Environmental Tests Urged

To evaluate best the serviceability of glass for a given process, samples should be tested in the environment. A trace chemical in a reaction may have a detrimental effect on the glass lining and indicate that a process change may be necessary if glassed equipment is to be used.

Maximum operating temperature of glass-lined equipment is determined by the corrosiveness of the materials with which it comes in contact. In general, non-ionic solutions may be handled up to 475°F. All common mineral acids except HF and hot, concentrated phosphoric can be processed at 300-375°F and even higher for short periods.

While concentrated alkalis may be stored at room temperature, maximum pH that can be handled safely at 212°F is 12.



***Small areas** up to 3" diam can be conveniently patched by use of a dished tantalum disc. The device is simply tightened in place with a tantalum stud and nut, gasketed against the glass with Teflon. Corrosion-resistant cement is used between damaged area and the patch.*

Rules of Thumb

When working with glass-lined equipment, the following points should be remembered:

1) Glass is attacked by fluorides.

2) It is susceptible to mechanical shock damage and will chip or break when subjected to hard blows from either glassed or steel sides.

3) Thermal shock can injure glass. Published recommended temperature differentials should not be exceeded. A partially-filled reactor may suffer damage when a cool liquid is permitted to run down the sides of the hot glass surface above the main liquid

level in the unit.

4) Direct steam impingement is corrosive to glass.

5) Glass is not greatly abrasion-resistant. Slurries which contain coarse, insoluble materials which can scratch and erode glass should not be processed in glass-lined units.

Installation Hints

Here are some suggestions that should be kept in mind during installation:

1) Keep all nozzles, flanges, etc., covered to prevent accidental glass damage.

2) Do not weld on glassed equipment without recommendation from supplier. When welding nearby, protect glass from weld spatter.

3) Use proper torquing techniques to prevent overstressing of flanges.

4) Allow for expansion of pipelines. Furnish adequate number of pipe hangers. Do not permit pipe to exert bending moment on nozzles.

5) Install all gasketing carefully. Damaged or crimped gaskets may allow acids to attack uncoated parts of vessel. This can cause hydrogen to be generated, which in its atomic form diffuses through the steel lattice until it reaches the glass-steel interface. It then changes to molecular hydrogen, building up enough pressure to spall the glass.

6) Check baffles and agitator for clearance in nozzles before applying power.

Preventive Maintenance

Once glass-lined equipment is installed and in operation, there are a number of things that can be done further to assure a long, useful life.

A good clamping, locking or tie-back device on manhole covers will prevent accidental slamming and possible damage to cover or (even worse) to the manhole flange on the vessel.

The manhole flange may be very susceptible to chipping due to impact when charging solid materials from other containers. In such cases, a glass-coated manhole extension is recommended. The device can be easily replaced in

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For all your gasketing needs, choose from a complete line of Garlock materials. Regardless of service conditions, there is a specific Garlock style for the job.

In either sheet form or cut to your specifications, Garlock offers **Style 7021** synthetic binder and long fibre asbestos, superior for hot oil service at 700°F; **Style 7228** high quality neoprene binder and long fibre asbestos, for gasoline, naphtha, benzine and other hazardous liquids and solvents, temperature to 300°F; **Style 7705** synthetic binder with blue African asbestos fibre, excellent against hot and cold mineral acid; **Style 900** long fibre asbestos with synthetic binder, for service against steam, gas, air, temperatures to 700°F; **Style 7772,** long fibre asbestos with synthetic binder, white in color, for service in chemical and petrochemical process equipment where leeching is a problem, temperatures to 700°F. Other gasketing materials available to meet your specific requirements.

In rubber sheet form, Garlock offers Style 7986 Neoprene sheet for flanged joints where oil resistant qualities of neoprene are required; **Style 8495** Buna-N sheet for gasketing against oils and solvents at temperatures up to 300°F; **Style 7992** Neoprene rubber diaphragm sheet for wet natural gas, gasoline, oils at medium or high pressures; **Style 9296** Silicone-Dacron diaphragm sheet for hot or cold air, high aniline point oils and many fire resistant fluids at temperatures to 300°F.

For prompt delivery, complete gasket cutting facilities are available in Palmyra, N. Y., Houston, Texas, and San Francisco, Calif. Get details by contacting the nearest of the 26 Garlock sales offices and warehouses throughout the U. S. and Canada. Or, write Garlock Inc., Palmyra, N. Y.

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Check 5160 opposite last page.

the event of glass damage without the vessel's being taken out of service.

Removable caps should be specified for tips of thermometer wells. In event that tip becomes damaged, it can easily be replaced without the removal of the entire well.

If steam sparging is necessary, it should be done by means of an alloy sparger tube. In addition, the top head should be insulated to prevent corrosion and spalling from steam condensate.

Scheduled Inspections Essential

A good preventive maintenance program should provide for a definite inspection schedule. The following are of major importance during such a checkup:

1) Use of a reflector-type light will help disclose spalls or chips in glass lining.

2) When entering a vessel, guard against scratching the glass or dropping tools. If ladder is used, be sure that its legs are padded.

3) C-clamps should be checked for damage. They should be kept oiled so they may be retightened easily.

4) All gaskets and plugs should be checked for leaks.

5) To maintain heat transfer characteristics, it is good practice periodically to clean out heating or cooling jackets. Under no circumstances should an acidic solution be used for cleaning, since an acidic solution can lead to spalling due to release of hydrogen. Here are two recommended cleaning solutions and procedures that may be used for this purpose.

a) Mix 2½ gal sodium hypochlorite in 100 gal water. Circulate through jacket at room temperature for about 5 hr. Drain and flush with high-velocity water.

b) Dissolve 56 lb NaOH, 38 lb Versene-100 and 26 lb triethanolamine in enough water to make up a 100 gal solution. Circulate through jacket at 100-120°F for 3-5 hr. Drain, flush with high-velocity water.

6) If equipment is used out-

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...EDITED BY A STAFF OF EDITORS UNEXCELLED IN TECHNICAL TRAINING, IN CPI* ON-THE-JOB EXPERIENCE, PLUS MANY YEARS OF JOURNALISTIC ACHIEVEMENT.

THE "OTHER FIVE"—

Of the other five major chemical magazines, three (3) serve professional and association interests of chemists and chemical engineers, whether they are employed in the CPI or in other non-industrial pursuits; one (1) presents weekly news of professional and association interests; one (1) offers general news weekly, of finance, personnel changes, marketing, sales

CHEMICAL PROCESSING is *vastly different* from all other chemical magazines for its editorial appeals directly to Operating Management of the CPI*. Logically its reader audience is vastly different.

Who is "Operating Management"?

CHEMICAL PROCESSING's reader audience is made up of those who direct and control actual productive operations in chemical process plants . . . in contrast to the "technical specialists" in chemistry and chemical engineering.

Major chemical process plants report, in a current study, that of their men in "key positions"—

17% hold chemistry degrees
37% hold chemical engineering degrees

while

46% hold "other degrees" or "no" degree.

Obviously, "operating management" men must be, and are, selected from those demonstrating managerial ability . . . whether college years brought them technical degrees or not.

The 46% of "key position" operating men *without chemical degrees* emphasizes the necessity of editing to this vital group in terms of management problems and opportunities. And today the 17% and the 37% of management men with degrees are no longer simply "chemical specialists" . . . they too are *operating management* in function, responsibility and in their thinking.

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Regardless of what magazines you use to reach "chemical specialists," **CHEMICAL PROCESSING** is a "must" to complete your advertising to chemical process plants. For, after all, what product or service is bought without favorable decisions of Operating Management!

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doors in cold climates, never allow water or condensate to collect in the jacket. Freezing can cause expansion and damage to glass.

7) Never permit spilled acid to remain on the outside of vessels. Extra care must be given to insulated units, where acid can seep under insulation and attack without detection.

8) Rotary mechanical seals are precision assemblies and provide excellent service when proper precautions are followed. To insure absence of grit particles that can ruin carbon faces, filters are recommended for oil lines used to pressurize seals. Flush out a seal before it is initially used. Always maintain seven psi more pressure on the seal than is inside the vessel in order to prevent the corrosion of seal parts from acid vapor from the vessel.

Repairs Can Be Effected

Even with the best of care, glass-lined equipment may accidently become damaged. Most interior damage, with the exception of extensive thermal shock, can be repaired with tantalum, gold, Teflon or some other corrosion-resistant material.

Small areas up to three inches in diameter can be conveniently patched by use of a dished tantalum disc. The device is simply tightened in place with a tantalum stud and nut, gasketed against the glass with Teflon. Corrosion-resistant cement (furan, phenolic or ceramic) is used between damaged area and the patch.

Spalling or damage to nozzle radii may be repaired by means of tantalum sleeves which cover the radius and a portion of the nozzle neck.

When damage to the glass is too extensive for repair in the field, there is always the recourse of reglassing. The manufacturer of the equipment is best qualified to evaluate suitability for reglassing.

By reglassing, many companies have been getting as much as 15 years of service from their equipment . . . and that's really mileage! ■

ACE

HARD RUBBER-LINED STEEL PIPE

FOR MEN WHO LIKE MONEY-SAVING IDEAS

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Ask for helpful Piping Systems Data Bulletin CE-51/52

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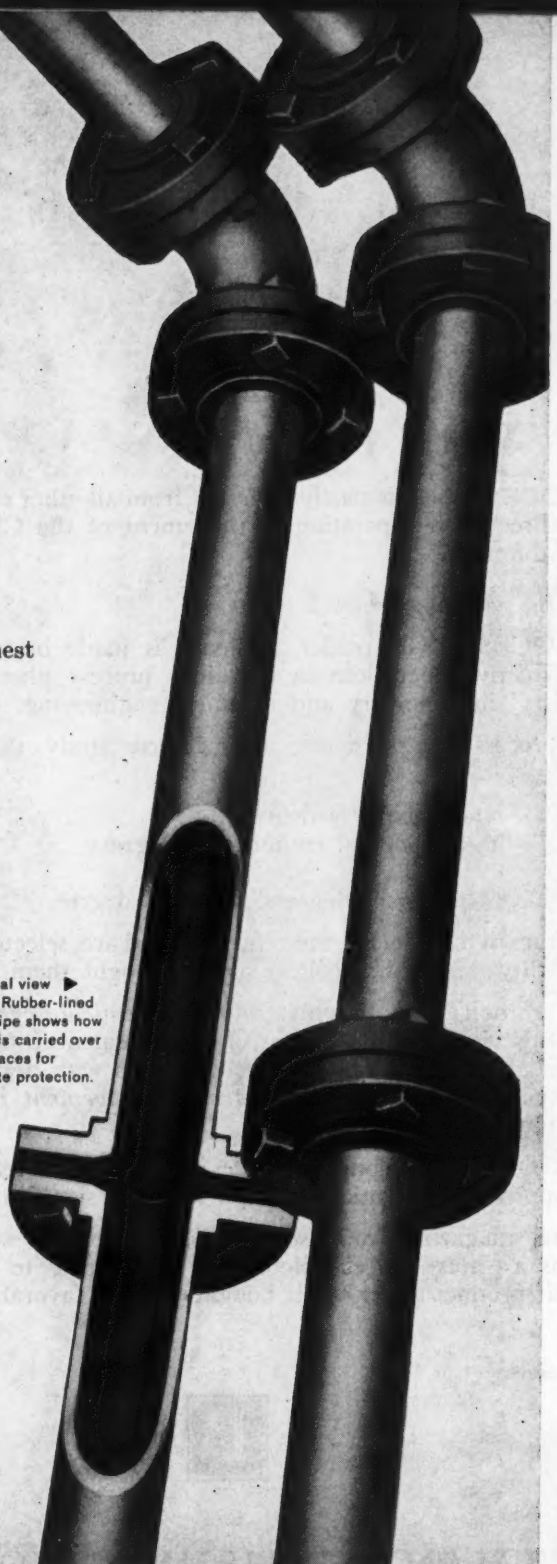

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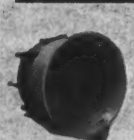

Rubber-lined steel tanks and special equipment. Also custom lining compounds for field application. **Bul. CE-53.**

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Acid pumps, centrifugal and gear types, fully protected by Ace Hard Rubber. Full line to 350 gpm. **Bul. CE-55.**

Ace Rubber-lined valves wear on when others wear out. Fully protected gate, diaphragm, check, and plastic types. **Bul. CE-51/52.**

For more information on product at left, specify 5161 see information request blank opposite last page.

If you're designing a high-temperature chemical process here, in capsule form, is up-to-date information that may help in . . .

Choosing alloys for 1200°F+ corrosive applications

JOHN J. MORAN is in charge of high temperature engineering, Technical Services, Development and Research Division, The International Nickel Company, Inc. He joined the company in 1951 at its Bayonne Works, Bayonne, New Jersey. In 1955 Mr. Moran transferred to the Development and Research Division as metallurgist in the Stainless Steel and Heat Resistant Alloy Section. He assumed his present position in 1960.

Mr. Moran received a B. S. degree in Metallurgy from MIT in 1948. He is a member of AIMME, ASM, ASTM and NACE.

By JOHN J. MORAN, In Charge, High Temperature Engineering
Technical Services, Development and Research Division
The International Nickel Company, Inc., New York, New York

SELECTING the right metal for tough corrosive applications is always difficult. Add elevated temperatures to this — say, above 1200°F — and you really have to watch your step. To insure getting the best performance for the costs involved, a number of important corrosion mechanisms and related factors must be taken into consideration before the final alloy is chosen. These points, and some of the latest findings pertaining to them, are briefly presented in this article.

Resistance to Air Oxidation Demanded in High Temp Use

With few exceptions, alloys intended for high-temperature service must possess good resistance to air oxidation. The alloying element contributing most to this property is chromium.

Two recently developed alloys appear to have excellent resistance to oxidation at very high temperatures (even above 2000°F). One, Inconel® nickel-chromium alloy 702, is a modification of the 80 Ni-20 Cr composition and contains about 3% Al. The other, Hastelloy X®, is a 45 Ni-22 Cr-18 Fe-9 Mo alloy containing minor additions of cobalt and tungsten.

Above 1200°F, at least 9% chromium is desired, and it would be desirable to have chromium in excess of 12%. For some iron-base alloys, the minimum amount needed goes up with increased temperatures. However, the incremental improvement is slight above 25% Cr.

The oxidation resistance of an alloy may be seriously impaired if stress is applied. This occurs because oxidation resistance, like most high temperature corrosion resistance, depends largely upon the formation and maintenance of a tightly-adherent, essentially-inert film, which acts as a barrier between the air and the metal.

A stress high enough to cause creep deformation will

To next page

Table I— Dry Hydrogen Chloride

	Approximate Temp, °F, for Inches Penetration/Month					
	0.0025"	0.005"	0.01"	0.05"	0.10"	Upper Temp Limit°F
Platinum	2300	—	—	—	—	2200
Gold	1800	—	—	—	—	1600
Nickel	850	950	1050	1250	1300	950
Inconel® Alloy	800	900	1000	1250	1350	900
Hastelloy® B	700	800	900	1200	1300	850
Hastelloy® C	700	800	900	1150	1250	850
SS Type-316	700	700	900	1100	1200	800
SS Type-309 + Cb	650	750	850	1050	1150	800
SS Type-304	650	750	850	1100	1200	750
Carbon Steel	500	600	750	1050	1150	500
Monel® Alloy	450	500	650	900	1050	450

Table II — Nitriding Corrosion

Alloy	Rates in Inches Penetration per Year A*	B**	B***
80 Ni-20 Cr	2×10^{-5}	0.0074	0.020
Inconel Alloy	None	0.0063	0.025
60 Ni-15 Cr	None	0.0074	0.028
SS Type-310	14×10^{-5}	0.0535	0.073
SS Type-309	23×10^{-5}	0.0950	0.086
SS Type-304	59×10^{-5}	0.0995	0.144
SS Type-446	112×10^{-5}	0.1645	0.143

*Based on 29,164 hours in ammonia converter at 490-550°C and 5,200 psi.
**Based on 1,540 hours in plant ammonia line at 500°C.
***Based on 939 hours in tubular heater in 20:1 mole ratio of ammonia to organic gas.

disrupt the film and permit oxidation to proceed at an uncontrolledly high rate. Austenitic stainless steels have greater creep resistance than ferritic steels.

Another important factor which may affect oxidation resistance is thermal cycling. Many alloys perform well under isothermal conditions, but will corrode quickly when subjected to rapid temperature changes. The explanation is that the protective oxide film ruptures and spalls under the action of the resultant thermal stresses. A high nickel content is favorable under thermalcycling conditions.

H_2S Is Destructive

Sulfur in several respects can be more damaging to alloys than oxygen — especially if the sulfur is present in a reducing atmosphere such as H_2S. Although unalloyed iron and nickel are rapidly attacked by sulfur, chromium affords considerable protection.

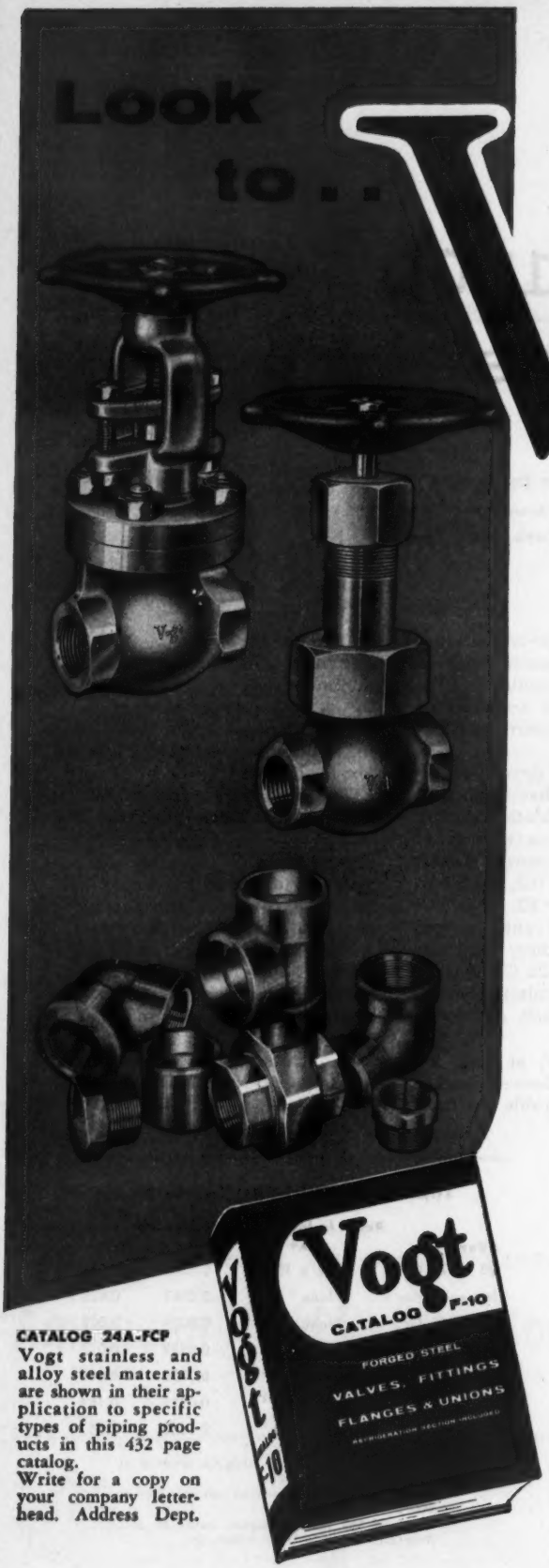
Under strongly sulfidizing conditions, it is also advisable to select an alloy having a high chromium content with no more nickel than is needed to provide the required mechanical properties and structural stability.

Halides and Nitriding

There are two reactive environments which are classed with high temperature corrosion although the temperatures involved are usually below 1200°F. The first of these involves halogens. Table I shows performance of various metals in a dry hydrogen chloride atmosphere. Similar data are available for chlorine and fluorine.

The second environment is nitriding. The formation of a brittle nitride layer on exposed metal surfaces often results in serious destruction. Alloys high in nickel provide maximum resistance in range of 800–1200°F. Table II illustrates the behavior of some alloys in three nitriding environments.

Fused fluorides are powerful



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CATALOG 24A-FCP
Vogt stainless and alloy steel materials are shown in their application to specific types of piping products in this 432 page catalog.
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Check 5162 opposite last page.

ARE YOU BUYING TUBE BY THE YEAR?

If a shortage of fresh water for heat transfer operations is causing your company to use sea water or brackish waters for heat removal duty, here are some mighty important facts for your consideration:

(1) In salt water service, the corrosion rate of commercially pure titanium tubing has been calculated at 0.001" in 1250 years. In addition, tubing manufactured from titanium is immune to stress corrosion cracking in this type of service. Tests also indicate no apparent tendency toward crevice corrosion nor is there any indication of pitting from marine growth deposits.

(2) On the other hand, the tendency of some ferrous and nonferrous metals toward corrosion cracking and pitting with corrosive elements on the tube side and sea or brackish water on the shell side makes frequent maintenance and material replacement a costly procedure . . . TITANIUM ELIMINATES THIS COMPLETELY.

(3) Because of its resistance to corrosion in this type of service, thin walled titanium tubing can be specified as can thinner sections for other components. The result is greater heat transfer efficiency and, because of greatly increased operating life, a lower prorated cost per foot for titanium heat exchanger tube . . . the tubing that gives *years* of service instead of only *months*.

This is but one of a number of areas where Wolverine titanium heat exchanger tube can bring increased heat transfer efficiency at lower costs. Why not have Wolverine Tube's Field Engineering Service staff analyze your heat transfer operations? All you have to do is fill in and mail the data sheet on the reverse side of this page. There is no obligation. Do it today!

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TITANIUM COMPARISON CHECK SHEET

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Allen Park, Michigan

GENTLEMEN:

We are interested in the possibility of using titanium heat exchanger tubing in our heat transfer operations. Will you please have your Heat Transfer Specialists analyze the following technical data and advise us if Wolverine titanium heat exchanger tube would be practical under the following conditions?

PLEASE ANSWER ALL QUESTIONS AS COMPLETELY AS POSSIBLE

1
a What is the O.D. of material in service?
b What is the wall size of material in service?
c What is the quantity of material in service?
d What is the alloy of material in service?

2 Describe corrosive product with percent of concentration.

3 What is maximum temperature of corrosive product?

4 What is tube side operating pressure?

5 Is environment oxidizing or reducing?

6 What is present tube life?

FILL IN AND MAIL

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fluxes. They will react with surface oxides on the metal to form compounds soluble in the salt and therefore unprotective. An extensive research program recently conducted has resulted in the development of an alloy capable of containing even molten fluorides used in homogeneous nuclear reactors.

Studies showed that both Inconel® alloy and Hastelloy® alloy B possessed useful resistance, but that the former was too high in chromium for long-time corrosion-free service in the molten salt. The Hastelloy® alloy formed an embrittling phase and also revealed an inadequate oxidation resistance. The alloy that was developed is known as Inor-8. It has the following nominal composition: Ni-71%, Cr-7%, Fe-5%, and Mo-17%.

Ductility, Impact Resistance Lessened by Carburization

Carburization consists of the absorption of carbon, almost invariably from a carbonaceous atmosphere rather than from solid carbon or graphite, and the subsequent formation of metal carbides in the alloy matrix. Although the initial effect is to strengthen the alloy, the concomitant loss in ductility and impact resistance may result in failure or detrimental changes in the alloy's mechanical and physical properties.

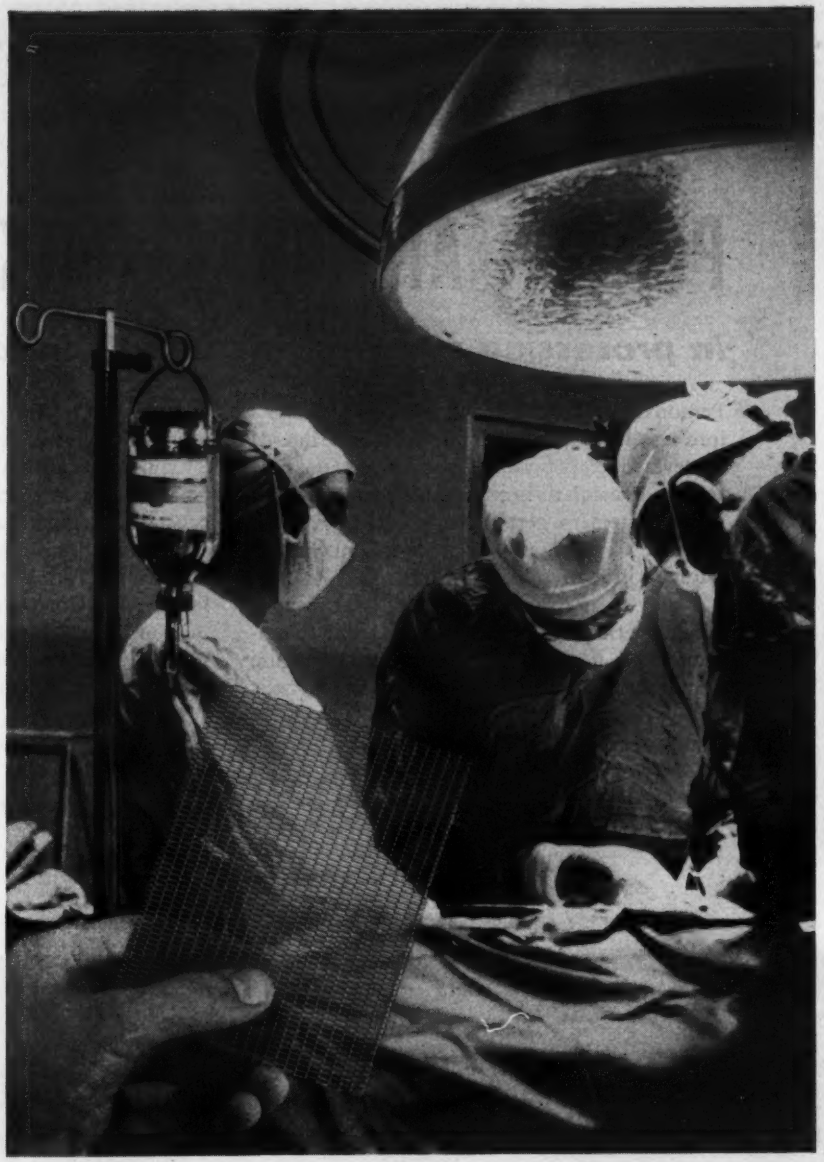
Methods To Fight Attack By Hydrogen Offered

Hydrogen at elevated temperatures diffuses readily through metals and tends either to collect at faults within the structure or to react with marginally stable carbides to form methane.

A corrective action for the latter is to add carbide-stabilizing elements such as chromium, titanium and tungsten.

To prevent hydrogen from collecting at faults, the use of "dirty" steels containing

For more information on product at left, specify 5163 . . . see information request blank opposite last page.



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stringers and seams should be avoided. Rimming steel, for example, should not be employed where hydrogen is being handled.

Creep, Stress Rupture Must Be Considered

The generally-accepted criteria for strength at high temperatures are creep and stress-rupture. It is essential that both of these be considered for each application in order to determine the limiting stress compatible with service conditions.

Obviously, it is not possible to run many 100,000 or even 10,000 hr tests although high temperature designs are often based on 100,000 hr rupture strength. It is necessary, therefore, to extrapolate from relatively short time data.

A number of techniques have been developed for this purpose with varying degrees of success, and the design data contained in most codes or standards are established in this fashion.

Methods will not be discussed in this article. However, it is suggested that before applying a given design value, the method of extrapolation be determined and, if possible, the original data examined.

Presence of Si, Mo, Ti, Nb Defeats Sigma

Another important design factor to be considered is the structural stability of an alloy at high temperatures for long periods of time. Of major concern is sigma formation. This brittle, intermetalic compound of nominally 50 Cr-50 Fe forms in susceptible alloys between 1200 and 1700°F.

Although its presence does not appear to be seriously damaging at high-operating temperatures, sigma can result in harmful loss of ductility and impact resistance when the alloy is subsequently cooled to room temperature.

Sigma is not usually found in type 18-8 stainless steel compositions unless the base alloy is modified by addition of such elements as silicon,

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In processing systems, it's what's inside that counts

Penton linings readily convert carbon steel tanks into vessels capable of handling corrosive liquids at elevated temperatures. Thus it is now possible to get corrosion resistance *inside* chemical processing systems, where it really counts, without recourse to the high-cost materials previously required in many use areas.

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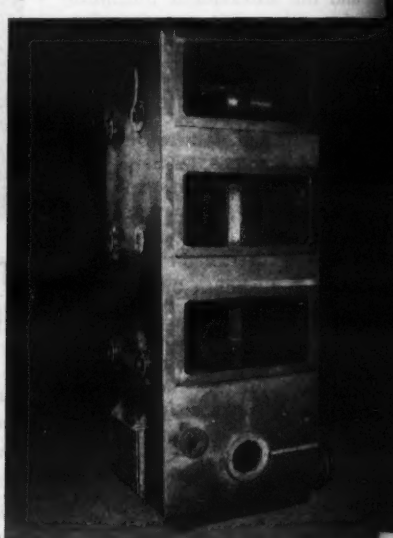
Want more information on Penton tank linings? Write for your copies of "The ABC's of Penton for Corrosion Resistance," and "The Penton Buyer's Guide," which includes a complete listing of Penton tank liners, and producers of other types of Penton processing equipment.

Cellulose Products Department
HERCULES POWDER COMPANY
INCORPORATED
Hercules Tower, Wilmington 99, Delaware

CP61-1

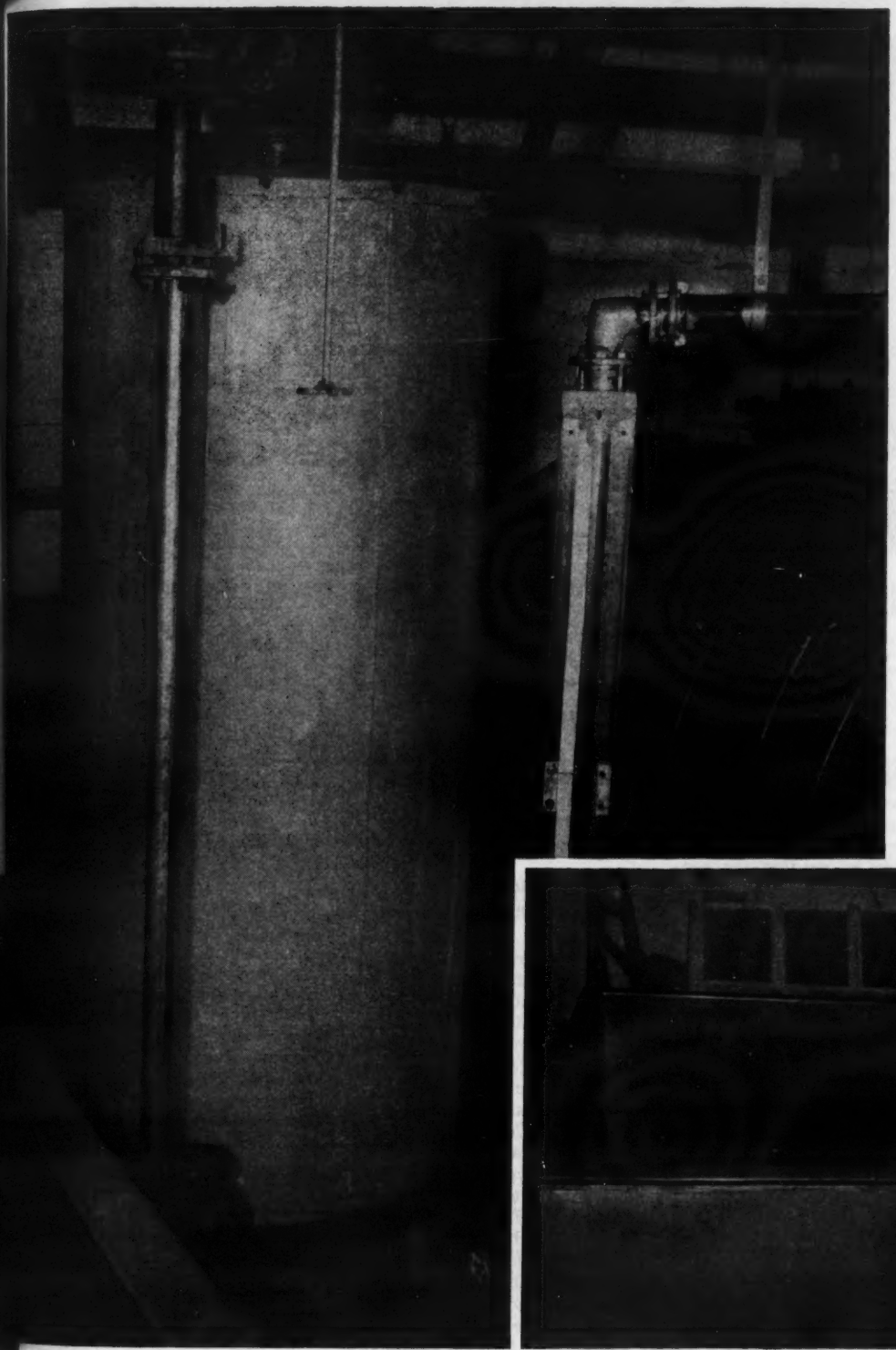
Penton sheet used in fabricating tank linings illustrated on these pages manufactured by Garlock, Inc., Camden, N. J.

Courtesy, Electro Chemical Engineering Co., Emmaus, Penna.



Courtesy, Mercer Rubber Corporation, Little Ferry, N. J.

TAILORED TO YOUR SPECIFIC NEEDS. The complex shapes shown here demonstrate the versatility of Penton linings applied to low-cost metal substrates for high temperature corrosion resistance. Penton-lined pipe and fittings, valves, meters and pumps can be used in conjunction with such vessels to supply a complete anticorrosion processing system based on Penton.



Courtesy, Electro Chemical Engineering Co., Emmaus, Penna.

USE IT WITH CONFIDENCE. This Penton-lined tank installed in a large East Coast chemical plant has already celebrated its first anniversary of trouble-free service. Used for off-gas condensate, it handles a mixture of 15% HCl and 69% acetic acid in water, at temperatures ranging from 170°F. to 212°F.

Courtesy, Buckley Iron Works, Dorchester, Mass.

ECONOMICALLY APPLIED. Penton linings for large tanks and processing vessels are achieved by the use of adhered sheet ranging in thickness up to 40 mils, applied to low-cost metal substrates with a straightforward adhesive system and conventional gas welding.

Check 5165 opposite last page.

molybdenum, titanium and columbium. A recent study has shown that over a seven-year exposure at 1350°F the impact resistance of types 316 and 321 stainless steels dropped from greater than 60 ft lb to 10 or less.

Increases in carbon, nitrogen and nickel tend to suppress sigma formation. Alloys with more than 30% nickel do not form sigma even though the chromium content may reach 20-25%. ■

Isopolyester resins combat corrosion, cut repair costs

Latest progress reports indicate that low-cost isopolyesters are proving successful in combating corrosion and cutting maintenance costs. The non-toxic plastic resins have been undergoing rigid tests for the past three years.

Made from isophthalic acid, the resins have given good performance in three applications: As patching compounds, as coatings for new equipment, and as glass-reinforced bottoms for storage tanks corroded to a point where patching is economical.

Some equipment repaired by isopolyester resins has been in service two and a half years and shows no signs of failure. In addition to long life, use of the material results in 50 to 70% savings in costs when compared to conventional repair methods.

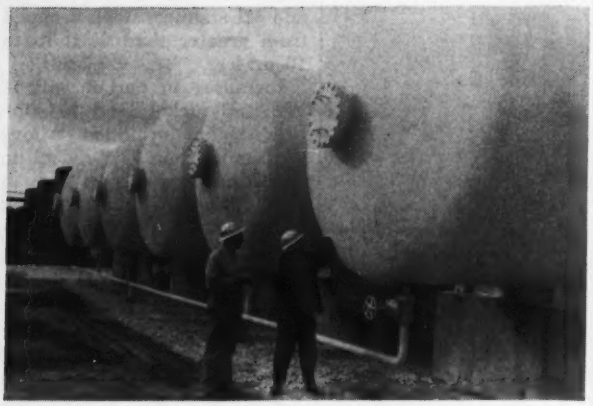
Formulations can be varied making it possible to obtain flexible resins with excellent impact properties, or rigid resins with good chemical and high temperature resistance.

(More information about isopolyesters can be obtained from the Oronite Division, of California Chemical Company, 200 Bush Street, San Francisco, California.)

Check 5166 opposite last page.

For more information on developments in this section, check the Reader Service Slip.

CORROSION control
CHEMICAL PROCESSING



Corrosion engineers *check film thickness of vinyl coating on ammonium hydroxide storage tanks in a chemical plant in the Southwest*

How can you tell which is the best protective coating for your specific needs? Although there is no simple answer to this problem, here is some information that may make it easier for you to select the right one

Things you should know about maintenance coatings

By D. O. LACHMUND
Vice President
Amercoat Corporation, South Gate, California

CONTINUED EXPANSION in the chemical industry is resulting in complicated processes that subject plants and equipment to increasingly severe corrosive conditions. Along with this technical growth, however, new materials are developed that can be used to overcome many difficult corrosion problems.

Synthetic resin coatings certainly fall into this category. Many have already proved themselves to be an essential part of any industry where corrosion is a problem.

This article will be confined to a discussion of those materials which are suitable and practical for formulating into so-called "maintenance coatings." Maintenance coatings, by the commonly accepted definition are non-baked coatings used to protect structural steel, concrete, exteriors of tanks, piping and process equipment against the corrosive effects of weathering, salt air, chemical fumes and spillage. They are not specifically designed to withstand continuous immersion in water or chemical solutions, although many will do so.

It should be borne in mind that selection of the best and most economical coating cannot be made by consulting a chart or by reading the general descriptions that follow. The advice of a reputable manufacturer, preferably one who has had experience with all of these types of coatings, should be sought.

If there are unusual problems connected with a particular application which have not been previously solved, tests of one or more types of coatings may be necessary before a recommendation is made.

Certain synthetic resins and plastics can be formulated into excellent tank-lining materials which will give long-lasting and economical service, but which are not practical as maintenance coatings because of high cost, difficulty of application, special surface preparation or other factors. Some examples of these materials are the polyfluorocarbons, furans and polyesters.

Other materials which have recently appeared and have some interesting properties, but which have not yet been widely used, are the polyurethanes and chlorosulfonated polyethylene (Hypalon). Despite this fact, they merit a brief discussion.

Hypalon Resistant To Oxidizing Solutions

This chlorosulfonated polyethylene material resists strong oxidation, such as by ozone, oxidizing acids and hypochlorites. It maintains its flexibility and extensibility for an indefinite period. Hypalon has good resistance to heat and moisture. Coatings made of this resin can also withstand alkalies. Hypalon's disadvantages are its relatively high cost and difficulty in application. Its use has been restricted to special conditions such as direct spillage of highly oxidizing material.

Solvent and Abrasion Resistance Characterize Urethanes

There are two distinct types of polyurethanes which are most important:

1) The one-package, baked-type which are made from blocked isocyanates and polyfunctional, hydroxyl-bearing resins, such as polyesters, polyethers or epoxy resins.
2) The two-package coatings made from room temperature reactive, polyol-isocyanate adducts and polyfunctional, hydroxyl-bearing resins, the same as those mentioned above.

The general resistance of both types is quite similar; the baked coatings having somewhat superior resistance. Outstanding properties of the urethanes are: 1) solvent resistance, especially compared to other air-dried coatings; 2) abrasion resistance where wear is a factor; and 3) toughness. Resistance to impact is also excellent.

Disadvantages are yellowing on weather exposure when pigmented for light colors and some loss of adhesion on long exposure to water when specialized primers are not used. Urethanes also have a tendency to laminate between coats or between new and old applications, and cost is usually higher than epoxies. Urethane coatings have not been extensively used for

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Protective Coating Properties Chart

Type of Coating	Advantages	Disadvantages
Vinyl	Excellent resistance to chemicals, water and weather. Dries quickly, remains flexible. Easy to recoat or repair.	Relatively thin films. (High-build formulas are available). Not resistant to strong solvents.
Epoxy	Good, all-around chemical resistance, hard, thick films and solvent resistance.	Chalks in sunlight, usually requires mixing of two components, not resistant to oxidizing materials, tends to become brittle with age unless carefully formulated. Aged films difficult to recoat or repair.
Coal tar-epoxy	Good all-around chemical resistance. Economical.	Black only. Aged films difficult to recoat or repair.
Urethane	Tough, resists heat and solvents.	Discolors in sunlight, usually requires mixing of two components, tends to lose adhesion in water. Limited experience.
Chlorinated rubber	Versatile, usually has good adhesion.	Usually not as resistant to chemicals and weather as above coatings, depending on modifiers.
Inorganic zinc	Serves as permanent primer, is abrasion-resistant, prevents corrosion at bare spots. Maximum weather resistance.	Must be overcoated in chemical areas. Requires mixing of two components.
Hypalon	Is flexible, resists heat, moisture and alkalies.	High cost and difficulty in application. Limited experience.
Neoprene	Heavy film, good adhesion, flexible.	Application by brush. Has to be mixed on job. Difficult to get smooth film.
Furans	Highly chemical resistant, resists 300°F temperature and water.	Brittleness and poor adhesion.
Polyfluorocarbons	Excellent chemical resistance.	Difficult to apply, thin films, costly. Require high temperature baking.
Silicones	Resists temperature to 1000°F. Good weathering.	Black or aluminum only at 1000°F, limited chemical resistance. Unmodified silicones will not cure below 300°F.

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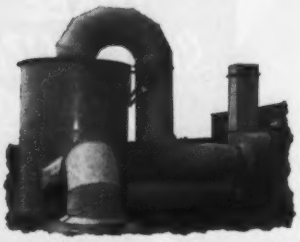
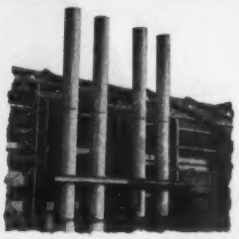


FUME SCRUBBERS—Packed tower and wet cyclone types in standard sizes from 1,000 to 30,000 C.F.M. Solid plastic, lined steel, stainless or alloy construction.



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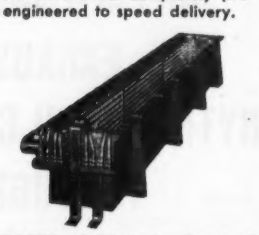
Complete ventilating systems—or individual components—including tank covers; fume collecting hoods and exhausters; ducts and fittings; stacks; centrifugal and axial fans; and fume scrubbers; all constructed of Heil service-proved Rigidon (reinforced plastic), Rigivin (rigid vinyl) lined or coated steel or alloys. Wide range of standard sizes permitting installation by your own maintenance men or local contractor.

Let the Heil corrosion engineers survey your needs and recommend the equipment that will provide utmost efficiency, economy and long, maintenance-free operation. Get full details—



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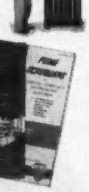
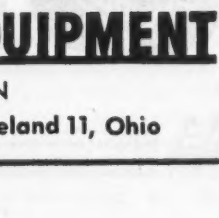
External heat exchangers in a wide range of standard sizes, also grid type immersion heaters with large surface areas to assure rapid heat transfer.



Send for bulletins describing Heil's complete line of corrosion resistant equipment,—Write Today!



CHEMICAL-PROOF LININGS · TANKS HEATERS PLASTICS

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Check 5168 opposite last page.

From page 54

maintenance purposes.

The most widely used chemical resistant organic maintenance coatings are those based on the epoxy, chlorinated rubber, neoprene and vinyl resins. By modification, and by variations in formulation, the basic properties of these resins can be changed to a considerable extent to suit a specific need. For example, inherent brittleness can often be reduced by the use of a plasticizer or other modifying agent. Inferior weathering resistance can sometimes be improved by proper pigmentation.

Heavy Film Thickness Furnished by Neoprene

One advantage of neoprene coatings is that a heavy film can be developed from them which has good adhesion to most metal surfaces when applied over a proper primer.

Neoprene films are flexible. They are generally resistant to non-oxidizing acids, salts and alkalis. However, they usually must be applied by brush, which on a large job results in high application cost.

Four Types of Epoxies Are Available

Epoxy coatings essentially come as four types. These are: 1) the baked epoxy-phenolic; 2) amine-catalyzed ambient temperature cure; 3) polyamide epoxy; and 4) epoxy-ester type.

The baked phenolic-epoxy combination has greatest overall chemical resistance. However, it is not recommended for oxidizing agents, such as nitric or chromic acids, hypochlorite or similar materials. It does stand up well in most solvents and many chlorinated hydrocarbons.

The amine-cured coatings have somewhat less chemical resistance than the baked phenolic-epoxies. The polyamide epoxies have excellent alkali and water resistance, but less resistance to acids and solvents than the amine type. The epoxy ester coatings are limited by the drying oil

Which valve alloy?

Corrosion testing, which often includes analysis of test specimens like those shown above, insure Aloyco valve customers of the right alloy for each job. Typical metals used in Aloyco Valves: Types 304 and 316 Stainless Steel, Aloyco 20, Nickel, Monel, Hastelloy B, C and D.

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See in Corrosive Service

ALLOY STEEL PRODUCTS COMPANY

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which is used for esterification.

The baked epoxy and the amine-cured epoxy coatings are the two most used for strong chemical resistance. However, they do not withstand moisture and weathering too well.

Epoxy Resin-Coal Tar Provides Economical Protection

Combination of epoxy resins and coal tar forms a coating which brings together the good properties of both products. Epoxy-coal tar coatings represent one of the recent major advances in the protective coating field. They have had good acceptance. Material may be cured to an insoluble film by the addition of amine catalysts. A very heavy film is obtained that is tough, hard and unaffected by most solvents.

It has been very successful for coating bottoms of gasoline and crude oil storage vessels, as well as fresh-water and sea-water tanks and structures among other applications.

Chlorinated Rubber Resists Acids, Alkalies

Coatings of this type are based on resins made by chlorinating natural rubber. Two principal coatings are available — one a solution of chlorinated rubber resin plasticized with chlorinated plasticizers, and the other a blend of chlorinated rubber with alkyd resins or other saponifiable plasticizers.

Resistance to acid and alkali is fair to excellent, depending on the plasticizer. Drying by solvent evaporation, the coatings are resoluble in the same solvents. Resistance to petroleum oils and alcohols is fair. Coatings are dissolved by aromatic hydrocarbons, esters and ketones. Also chlorinated rubber is softened or plasticized by animal or vegetable fats and oils.

Silicone coatings, which will resist temperatures up to 1000°F, are used for stacks, furnaces and similar applications. Coatings for 1000°F are available only in aluminum or

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a new, low cost method to prevent rust and corrosion

CRC 3-36 eliminates corrosion by a dual action. First, by separating moisture from the metal surface; second, by sealing the surface against re-entry of moisture and corrosive atmospheres.

Check these benefits:
Easy to apply . . . either by spray, brush or immersion.
Affinity for metals . . . spreads quickly, penetrates and clings to grain boundaries, pores and cracks.
Economical . . . extremely low surface tension makes a little go a long way.
Need not be removed . . . will not affect subsequent manufacturing procedures, painting or plating.

In addition, this formula prevents intergranular corrosive action and insulates dissimilar metals to prevent electrolysis. It is equally effective on painted or plated surfaces which are inherently porous, preventing minute sub-surface corrosion which leads to complete failure.

CRC 3-36 penetrates any scale formation and breaks the interfacial tension that binds corroded parts. It prevents fingerprint corrosion, aids cleaning and has a beneficial lubricating effect on moving parts.

CRC 3-36 will not trap moisture against the surface and its thin film will never become hard or brittle. It does not have to be removed before subsequent manufacturing operations.

Whether your rust and corrosion control problem is related to storage of metal stocks, in-process material or equipment, packaging or shipping, CRC 3-36 does an effective job and will save its cost many times over by eliminating deterioration due to moisture.

Call your local industrial supply distributor for a trial order—today! Or, write for complete information to:
CORROSION REACTION CONSULTANTS,
a subsidiary of the Chas. J. Webb Sons Co., Inc.
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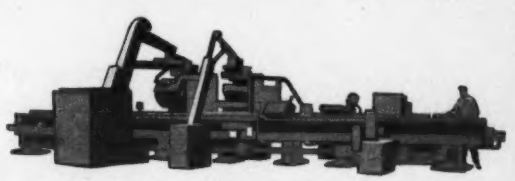
DURING STORAGE

DURING PRODUCTION



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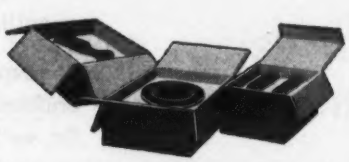
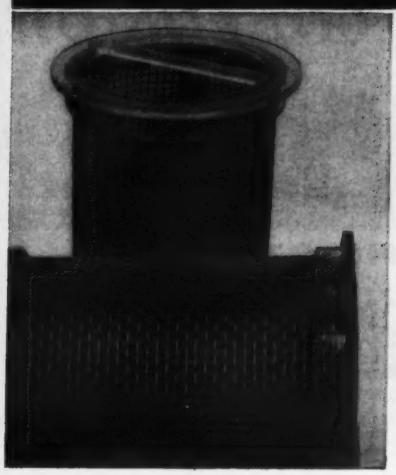


CRC FORMULA 3·36 METALS INDUSTRY

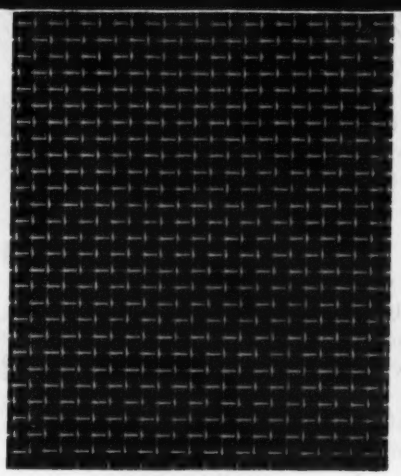
RUST AND CORROSION PREVENTION PROGRAMS

Check 5170 opposite last page.

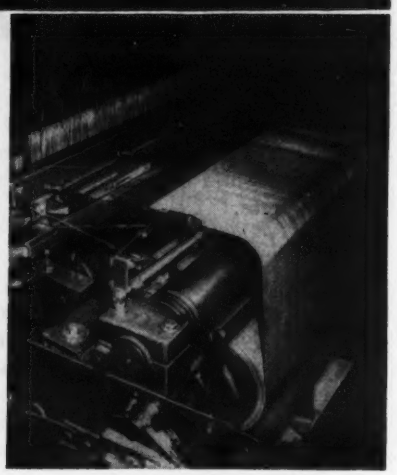
Need Wire Cloth in Special Metals? call *Cambridge*



HASTELLOY C*



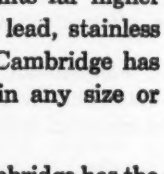
SILVER



TITANIUM

Working with unusual metals or alloys—as well as with standard metals and alloys—is almost an everyday occurrence at Cambridge. For instance, not too long ago, we developed the first practical method of weaving titanium into wire cloth—with mesh counts far higher than had been expected by the customer. Platinum, lead, stainless steel, or bronze—whatever the metal or alloy used, Cambridge has the experience and facilities to produce wire cloth in any size or quantities to the closest tolerances.

If you require fabrications—of any shape or size—Cambridge has the craftsmen and know-how to fill even the most rigid specifications. Or, we'll draw up prints for your approval. There's a wire cloth expert near you—ready to discuss your needs and show you how to get what you want economically and on time. He's your Cambridge Field Engineer... and his name is listed in the Yellow Pages under "Wire Cloth." Or, write for our illustrated, 120-page catalog.



Refer to our technical data sheets in CHEMICAL ENGINEERING CATALOG, Page 185

The Cambridge Wire Cloth Co.

DEPARTMENT F • CAMBRIDGE 8, MARYLAND

Manufacturers of Wire Cloth, Wire Cloth Fabrications, Metal-Mesh Conveyor Belts and Gripper® Metal-Mesh Slings.

*Reg. T.M. of Union Carbide Co.

Check 5171 opposite last page.

black. However, a range of colors is available for temperatures up to 500-650°F.

Vinyls are Chemical And Weather Resistant

Vinyl coatings form a very homogeneous, tight film over various surfaces. In addition to excellent toughness and chemical resistance, the film tends to exclude oxygen and ions from the surface over which it is applied. Vinyl coatings are inert to almost all inorganic acids, alkalies and salts, as well as water, grease, alcohols and similar materials.

Vinyls may be applied quickly and surface dry within two to five minutes. Their water absorption is almost negligible. Weathering tests in Florida have shown that coatings of this type remain unchanged in appearance after more than 10 years of continuous exposure.

Disadvantages are practically all tied in with application. Formerly, vinyl coatings were relatively thin; therefore, multiple coats had to be applied in order to build up a proper and workable thickness. High solids coatings now available minimize this problem. Airless spray techniques make it possible to apply up to eight mils per coat. It is essential that surfaces to be coated are clean in order to obtain proper adhesion.

Inorganic Zinc Coatings Have Wide Use for Maintenance

Although not based on synthetic resins, an important generic coating category is the inorganic zinc-filled type. This material provides a hard abrasion-resistant film which, in only one coat, will give years of protection to steel exposed to moisture, salt air or solvents. A coating of this type is widely used on the interior of floating-roof tanks, where its resistance to weather, solvents and abrasion results in superior protection to that obtainable with other types of material.

Outstanding performance has been achieved in chemical plants by using an organic,

resinous top coat, such as an epoxy or vinyl, over an inorganic zinc-filled coating. In this system, the zinc becomes a permanent primer. The zinc prevents corrosion from any moisture that may permeate the top coat while the top coat protects the zinc from the larger ions which might attack it. Zinc also eliminates corrosion at bare spots by providing a degree of cathodic protection.

No attempt has been made in this article to cover all types of protective coatings. Where corrosive and weathering conditions are mild, conventional paints are often the simplest and cheapest solution to the problem.

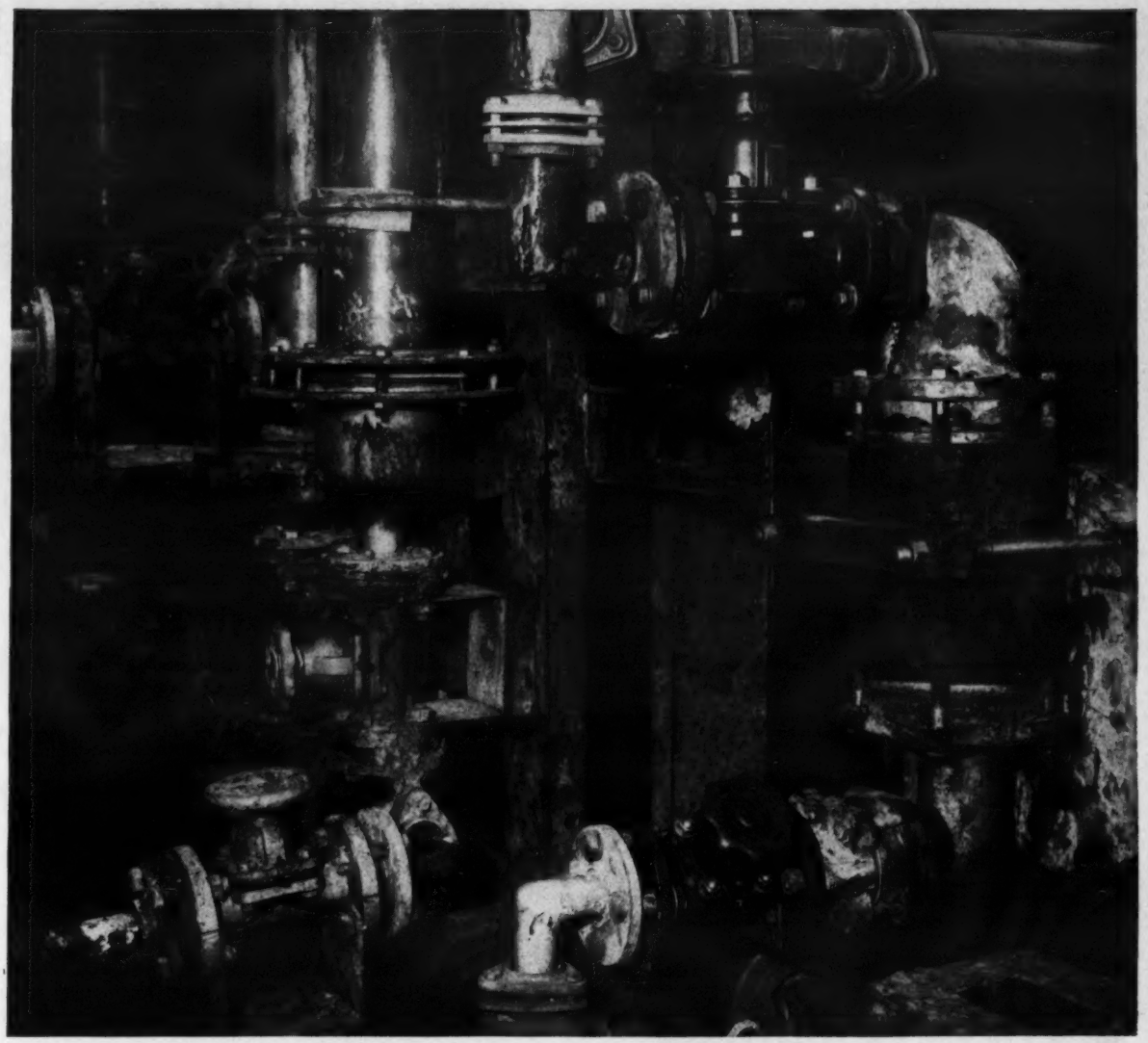
The present trend in chemical plants is toward the use of vinyls for general maintenance with epoxies used for areas of solvent fumes or higher temperatures. Both types when applied over an inorganic zinc coating give maximum performance. This combination is reported to be the most economical and effective approach to maintenance painting.

The outstanding advantages and disadvantages of the widely used chemical-resistant maintenance coatings are listed in accompanying table. The overall conclusion which can be drawn from the data in the table is that vinyl coatings are generally more resistant, but epoxy coatings are thicker. This high film build attainable from epoxy coatings is probably the main reason for their recent wave of popularity.

However, the high build vinyl coating, applied by airless spray, offers more than adequate coating thickness and retains all the other advantages of vinyl coatings. These include weathering, lower permeability, one package (no catalyst mixing), and faster drying at low temperatures. ■

Story of how a manufacturer developed a special alloy steel die to eliminate corrosion troubles in pellet mills is told in four-page bulletin. Although device is about 50% more costly than a conventional die, its longer life makes up for this. Bul 233 — Sprout, Waldron & Co., Inc.

Check 5172 opposite last page.



Encrustation on two of the above valves was cleaned off to show lack of external corrosion. Compare this with the corroded condition of the structural steel.

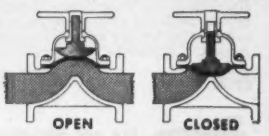
Grinnell-Saunders Diaphragm Valves resist attack by hot corrosives at Carborundum Metals Company

During the past few years, Carborundum Metals Company, a Division of the Carborundum Company, has installed over 200 Grinnell-Saunders Diaphragm Valves at their Parkersburg plant in West Virginia. These valves were coated internally and externally with Penton * —and were equipped with fluorinated plastic diaphragms, backed with elastomer cushions. Their job: to handle highly corrosive caustic soda and sodium hypochlorite–at 212°F, and methyl isobutyl ketone, hydrochloric acid, sulphuric acid at 130°F–all used in processing zirconium ore for zirconium and its co-product, Hafnium.

Today, this manufacturer reports that after being in operation an average of two years, the rugged Grinnell-Saunders Diaphragm Valves are still giving good service. What's more, they've never had to replace parts in these Grinnell Valves!

In Grinnell-Saunders Valves, the diaphragm lifts high for streamline flow – seals *tight* for positive closure. Working mechanism is completely isolated from material in the line to prevent corrosion and contamination. There's a wide choice of body, lining and diaphragm materials, too. See how Grinnell-Saunders Diaphragm Valves can help *your* installation.

Write Grinnell Company, Providence 1, Rhode Island.



* *Reg. T.M., Hercules Powder Co.*

GRINNELL

GRINNELL COMPANY, PROVIDENCE 1, R. I. • BRANCH WAREHOUSES AND DISTRIBUTORS FROM COAST TO COAST
PIPE FITTINGS • VALVES • PIPE HANGERS • PREFABRICATED PIPING • UNIT HEATERS • PIPING SPECIALTIES

Check 5173 opposite last page.

Chemical Degradation

CAN LEAVE YOU EMPTY HANDED!

Which of these filter media will solve your corrosion problems with maximum efficiency?

TFE ORLON HT-1 SARAN
DYNEL POLYETHYLENE NYLON POLYPROPYLENE WOVEN GLASS ACRILAN DACRON
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With hundreds of different fibers, constructions and grades of filter media available, it takes a specialist to guide you to the most efficient and economical material for any given job. Lamports engineers are qualified by years of experience in the field to advise you on any filtration problem. Double-check your present media with us, or let us help you plan your next installation. Technical assistance without obligation. Call, write, wire, or TWX.

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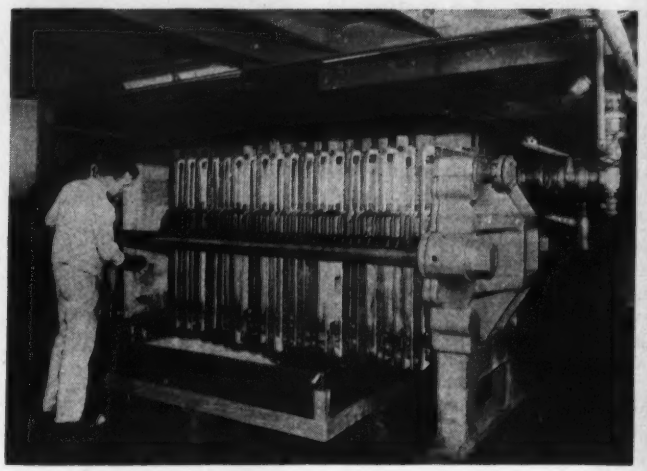
CORROSION control
CHEMICAL PROCESSING



Combining economy with durability, phenolic-resin wood impregnated plates and frames are expected to last 150% longer than previous units filtering pH 1-2 solutions at Wm. J. Stange Co.

Handling tough corrosives . . .

Resin-impregnated wood plates and frames pay out every year

TED F. MEINHOLD, Associate Editor
with **L. H. GROSBY,** Chief Engineer
Wm. J. Stange Company, Chicago, Ill.

Problem: Cypress filter press plates and frames corroded and deteriorated rapidly and could not be used after three months at Wm. J. Stange Company, Chicago, Illinois. Rubber-lined, iron plates and frames also were tried. Although their life was appreciably longer — approximately two years — they required considerable maintenance and repair to be kept functioning. Weighing 260 and 120 lb respectively, the plates and frames are awkward and difficult to handle.

A NEW SOLUTIONS FEATURE

The two 36″ presses, equipped with saran cloths, are used to filter food color intermediates that the company manufactures. In one operation, an organic acid slurry is filtered. The mixture has a pH 1.0 and is sent through the unit at 32-50°F.

In another case, a solution of sulfonated organic amine slurry mixed with dilute sulfuric and sulfurous acids is filtered at 70°F. This material has a pH 2.0 and contains 10.6% solids.

Solution: Three years ago, low-cost pine plates and frames, completely impregnated with phenolic resin, were installed. The finished, impregnated material is reported to be about 70% harder than the untreated wood. Crushing strength is 330% greater. Modulus of elasticity is up 25%.

When exposed to moisture, the impregnated units will shrink or swell as much

Grooves in wooden plates are in excellent condition even after three years of tough service

as 75% less than the original pine. They have excellent resistance to HCl, H_2SO_4, and oxalic, acetic and phosphoric acids at low concentrations. Salt solutions may also be handled without difficulty.

However, the finished wood is not recommended for extended service in strong alkalis, oxidizing acids, aniline, bleaching solutions or chlorine gas.

How It's Done . . .

The pine used for impregnation is especially selected for its small, uniform grain structure. In the process, the wood is placed into a pressurized autoclave, similar to those used to treat railroad ties and electric transmission poles. With a procedure combining vacuum and pressure, the precatalyzed, essentially-monomeric phenolic water solution is forced into the wood.

During this process, the low molecular weight resin not only enters the lumen of the wood cells, but actually penetrates the cellulose making up the cell walls. Upon completion of the impregnating process, the solution is drained from the unit.

Following impregnation, the treated wood is placed in a conventional dry kiln for moisture removal and, finally, polymerization of the resin at sustained, elevated temperatures.

The finished, resin-impregnated wood can be fabricated with the same equipment that is used for working with untreated wood. However, because of the greater hardness and strength of resin-impregnated wood, power requirements are slightly higher. Experience has shown that it is best to use high-speed carbon or Stellite tools.

Results: After three years of service, the phenolic-resin impregnated pine plates and frames have required no maintenance and show no signs of deterioration. It is estimated that they pay for themselves each year they are in operation. Useful service life is expected to be five years — 150% longer than that of the rub-

To bottom of page 72

POWELL PERFORMANCE PAYS OFF

Powell valve performance really pays off for the chemical industry. Take "reliability" for instance.

Powell reliability starts with good design features specifically tailored for chemical installations. For example, there is a deep stuffing box for an extra amount of special packing. And valve bodies are designed with full flow areas for maximum flow conditions and minimized pressure drop. Also, wedge discs are precision machined and fully guided to eliminate drag and wear of the seating surface as well as undue vibration.

You get thorough valve engineering like this—plus, industry's widest selection of valve materials, both ferrous and non-ferrous, so that Powell valves can withstand virtually any problem of corrosion, erosion, temperature or pressure. Whatever your valve requirements—look to Powell.

All this adds up to reliability that gives a performance pay off to you. Get the full story from your nearby Powell Valve distributor, or write The Wm. Powell Company, Cincinnati 22, Ohio.

115th year of manufacturing industrial valves for the free world

POWELL CORROSION-RESISTANT **VALVES**

THE WM. POWELL COMPANY CINCINNATI 22, OHIO

Check 5175 opposite last page.

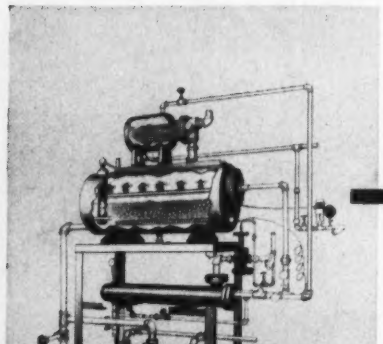
CORROSION
COSTS LESS TO STOP THAN IGNORE

Schaub Deaerators make corrosion more unnecessary than ever. Guaranteed to remove oxygen down to .005 cc/liter (Zero-Oxygen type), Schaub Deaerators stop the deadly corrosive action of oxygen in raw water which spells the early and costly replacement of boilers and lines. Your equipment will last longer and you'll get improved operating efficiency to boot!

SCHAUB DEAERATORS

guaranteed corrosion protection for any size plant

All Schaub Deaerators operate *fully vented* at atmospheric pressure for complete release of all air — without expensive pressure vessel construction. ".03" type uses exclusive Schaub spray-contact vent condensing method to stop wasteful steam vapor loss. Pinpoint temperature control and "live-action" heating insure highest-efficiency operation regardless of load variations.



Schaub Deaerators bring truly effective low-cost corrosion protection within the reach of *any* plant . . . make it more expensive to ignore corrosion than to stop it.

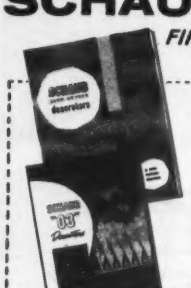
Write today for full information.

SCHAUB ZERO-OXYGEN DEAERATING SYSTEMS—(illustrated) for capacities to 250,000 lbs./hr., are **guaranteed** for .005 cc/liter oxygen removal over a 10 to 1 load swing—**without** sodium sulphite. Features Schaub explosive flashdown and fully vented operation.

SCHAUB ".03" DEAERATING SYSTEMS—for the small to medium size plant in the 3,000 to 100,000 lbs./hr. range. **Guaranteed** oxygen removal down to .03 cc/liter under even widely varying load conditions. Fully vented operation.

SEE
SCHAUB *FIRST*

Specialists in automatic boiler feed and condensate handling systems . . . boiler return systems • deaerating systems • "pree-heet" systems • transfer and boiler feed pumps • heat reclaim systems • console blow-down recovery systems • condensate return units • power plant specialties
SERVICE COAST TO COAST



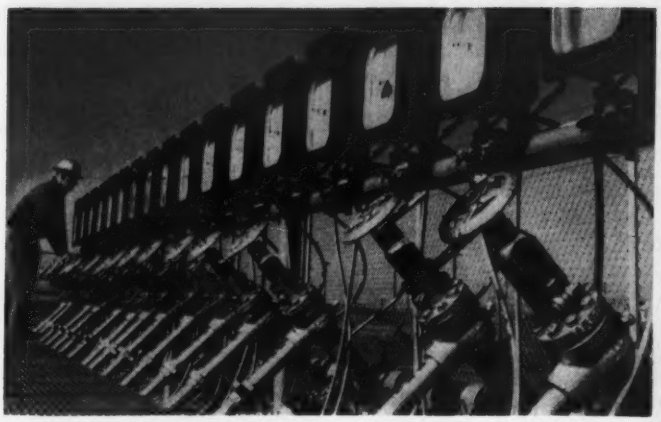
FRED H. SCHAUB ENGINEERING COMPANY
5312 Belmont Road, Downers Grove, Illinois

Please send me complete catalog data on
☐ Schaub ".03" Deaerators
☐ Schaub Zero-Oxygen Deaerators

Name_____
Company_____
Address_____
City_____ Zone____ State_____

Check 5176 opposite last page.

CORROSION control CHEMICAL PROCESSING



Employee opens valve on an injection well for secondary oil recovery at Shell's Dominguez, California, field

Water pipe 'watchdog' nips corrosion costs

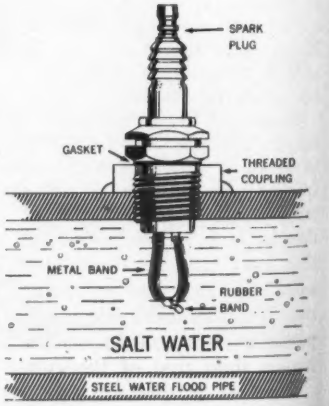
Five-dollar spark-plug-type detection device teams up with oxygen absorbent, prevents damage to injection pipes at oil company

Problem: Repairing leaks and replacing waterflood pipe damaged by pitting corrosion was costing Shell Oil Company as much as $100,000 per year. This type of corrosion is particularly troublesome because it eats small hollows in the steel pipes, causing them eventually to leak.

A NEW SOLUTIONS FEATURE

Shell currently is involved in more than 50 water flood projects in nine states. In 1960, the company produced about 6.6 million barrels of crude oil by secondary recovery through water flooding.

In this recovery method, salt water is pumped into wells which have lost much of their natural pressure. Injected water restores enough pressure in the oil-bearing formations to help force otherwise unrecoverable oil to a point where it can be pumped to the



Probe is threaded into side of water injection pipe above ground level. Inspectors can check for corrosion by use of simple circuit tester equipped with flashlight bulb. If metal band on bottom of plug is corroded, bulb will not light

surface and be utilized.

Solution: Laboratory tests at the company's Emeryville, California, research center disclosed that the basic cause of corrosion was traces of oxygen in the injection water. An imbalance of oxygen was created at places in the pipe where scale and dirt deposited.

This imbalance set up an electrical field that resulted in a steady stream of ions being released into the water from inside the wall of the pipe. A corrosive force thus was concentrated beneath each deposit.

The basic problem was solved by adding to the injection water an inexpensive chemical scavenger, such as cobalt-catalyzed sodium sulfite, which removes all traces of oxygen. This halted the destructive flow of ions and corrosion stopped.

Research chemist, P. J. Raifsnider, displays spark plug-type probe he invented to detect early signs of corrosion in steel pipe lines. Device is shown equipped with circuit tester

As an added precaution, a simple and inexpensive electrical resistance-measuring probe was developed and installed which could quickly detect these corrosive conditions if they occurred again.

As shown in the accompanying diagram, the device consists of a conventional spark plug, rubber band and a thin ribbon of steel. The steel ribbon is welded to the electrodes of the plug, forming a loop. The rubber band is tied around the bottom of the loop.

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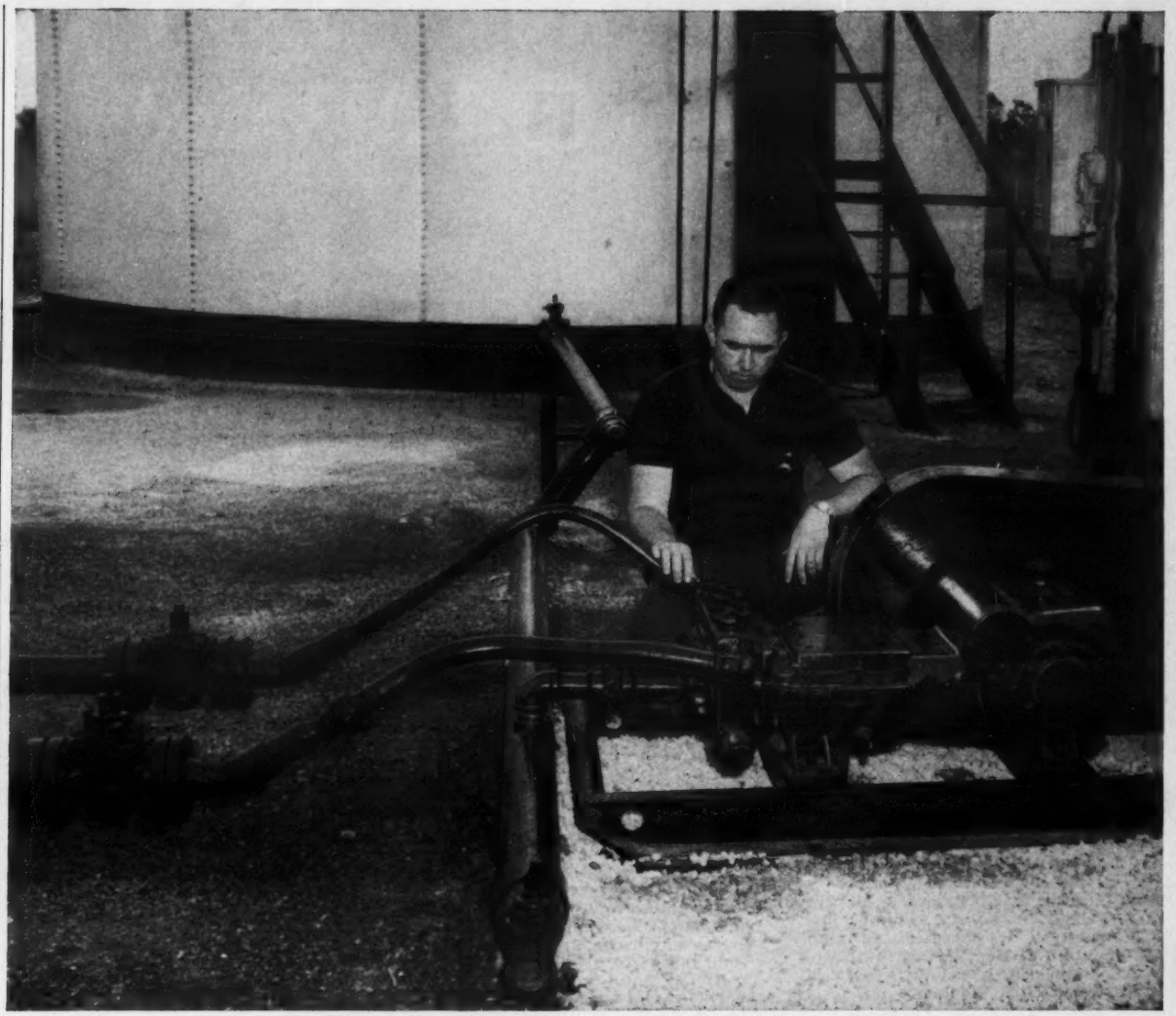


After 4½ years of moving a fluid (pH 6.25 at 77° F.) containing 11.2% chlorides and 18.1% solids at high velocity, the nickel-containing stainless steel valves in this Deming Triplex pump are still giving trouble-free service.

Cast Nickel Stainless Steel valves fight off erosion by high-velocity abrasive brine

Still going strong after 4½ years of trouble-free service

At Sinclair Oil & Gas Company's lease near Kiefer, Oklahoma, this reciprocating pump disposes of salt water, produced with crude oil, having a high concentration of corrosives and solids. Pumping rate is 750 bbl/day at 200 psi.

Abrasive solids speeding through valves at high velocity are very erosive. Because orifice size is very important, valves must operate with a minimum of metal loss to maintain the best conditions of plant operation; so, for all disposal pumps at this station, Sinclair specifies valves cast of CF-8M* nickel stainless steel.

Nickel Stainless Steel castings resist high-speed erosives and fight off corrosion, which may accelerate erosion. That's why CF-8M, containing 9% nickel, is such a wise choice to withstand the one-two punch of erosion-corrosion.

To keep your replacement costs down when high-speed erosives and corrosion threaten equipment, specify cast nickel stainless steel for cylinders, valve bodies, pump castings, and impellers.

How nickel stainless castings withstand erosion and corrosion is given in a 64-page booklet, "Heat Resistant Castings, Corrosion Resistant Castings . . . Their Engineering Properties and Applications." To have this information at your finger tips, send for your free copy today.

*Alloy Casting Institute designation

The INTERNATIONAL NICKEL COMPANY, Inc.
67 Wall Street INCO New York 5, N. Y.

INCO NICKEL

NICKEL MAKES CASTINGS PERFORM BETTER LONGER

Check 5177 opposite last page.

CORROSION control

CHEMICAL PROCESSING ... 8TH ANNUAL FEATURE

Corrosion Technical Literature

Here is information on new bulletins and brochures containing valuable data to help in fighting corrosion

Cost-saving potentials of sintered, corrosion-resistant titanium as a design material are discussed in four-page bulletin. Properties, tolerances and processing and specifying data are reviewed. Literature states that material has up to 300% higher strength/weight ratio than stainless steel and 200% less thermal expansion than aluminum. Bul 100 — Mechanical Research Division, Clevite Corporation.

Check 5178 opposite last page.

Chemical processing equipment made of reinforced plastics is pictured and described in 10-page catalog. Two-page insert lists chemical resistance of polyester resins in over 250 corrosive environments. Data is compiled from actual laboratory and field tests. "Reinforced Plastic Equipment" — An-Cor Industrial Plastics, Inc.

Check 5179 opposite last page.

Centrifugal pumps made of cast steel and stainless steel for corrosive service are pictured and described in two-page bulletin. C u t-away sketch reveals inner construction and major parts. Units are available in three standard sizes having capacities up to 1200 gpm. Cat Sheet 5141 — Carl Buck and Associates.

Check 5180 opposite last page.

Galvanic principle of inorganic zinc protection, both in immersion and non-immersion service, is discussed in four-page bulletin. Portion of literature is devoted to discussion of inorganic zinc coating. Use as tank lining and as high temperature coating is considered. Physical properties and application advantages are included. Bul 400 — Carboline Company.

Check 5181 opposite last page.

Properties of selected glasses are cited in revised 18-page brochure. Expanded data on corrosion resistance and thermal expansion of 32 commercial glasses are given. Numerical code system shows resistance of each product to weather, water and acid. Also included is information on evaluating hardness of glass. Bul B-83 — Corning Glass Works.

Check 5182 opposite last page.

Corrosion-resistant tanks made by patented filament winding technique are discussed in six-page bulletin. Process combines corrosion resistance of epoxy resin and high strength of glass filaments to obtain maximum benefit of both. Bul 45-115 — Black, Sivalls & Bryson, Inc.

Check 5183 opposite last page.

Chlorinated polyether coating for metal is reviewed in four-page, illustrated bulletin. When applied to exteriors of processing equipment, material protects units against damaging effects of acid spillage or ambient corrosive atmospheres. Product is recommended for service up to 210°F. Bul 1007 — The Pfaudler Company, Div. of Pfaudler Permutit, Inc.

Check 5184 opposite last page.

Solenoid valve selection for corrosive applications is discussed in 16-page, two-color booklet. Included are seven pages of valve selection charts, diagrams showing normally-closed and normally-opened configurations, a flow-versus-pressure-drop chart, and general information required to select right solenoid valve for a specific application. "Solenoid valve selections" — Valcor Engineering Corporation.

Check 5185 opposite last page.

Stainless steel processing equipment for pulp, paper and chemical industries is illustrated in product and service brochure issued by The Pulp and Paper Division of Portland Copper & Tank Works, Inc.

Check 5186 opposite last page.

Table comparing corrosion resistance of PVC with commonly used alloys is included in eight-page introductory section of engineering manual. Company's engineering and fabrication services for plastic pipe and equipment are also reviewed. Section One, Engineering Manual — Trans-Plastics Corporation.

Check 5187 opposite last page.

Solenoid valves having all wetted parts made of corrosion-resistant stainless steel or alloy-20; Monel, nickel or aluminum and Teflon are summarized in two bulletins. Units are available in either direct-operated or internal pilot-operated types. Bul 500 and 600 — The R. G. Laurence Company Incorporated.

Check 5188 opposite last page.

Design considerations for applying reinforced plastics in the corrosive environments of the process industries are cited in eight-page technical reprint. A table is presented for estimating degradation of tensile strength in reinforced polyester laminates under 14 practical service and production conditions. Factors concerning application, such as strength required for normal service, mechanical abuse, thermal conditions and chemical attack are discussed. Reprint "Design Considerations For Applying Reinforced Plastics" — Atlas Chemical Industries.

Check 5189 opposite last page.

Coating for protecting brick, steel and concrete chimneys from acid corrosion caused by high sulfur fuels is discussed in six-page brochure. Charts show test methods used and results obtained with the coating as compared to six conventional materials. Methods of application are explained. Eleven product data sheets are also included. "Stackfas" brochure — Benjamin Foster Co., Division of Amchem Products Inc.

Check 5190 opposite last page.

High-pressure tube made from rigid polyvinyl chloride is topic of four-page technical bulletin. Corrosion resistance to 45 common chemicals is shown. Physical properties at 78°F and specifications are also listed. Tube is available in sizes ranging from ¼ to ¾" diameter and can be used at temperatures between 0° and 140°F. Bul "Tuff-Tube" — Extron Corporation.

Check 5191 opposite last page

Cross-linked, epoxy-phenolic coating designed for use as corrosion-resistant tank lining is considered in technical bulletin. Product contains high ratio of phenolic and is cured with an alkaline curing agent. Physical specifications, zone of usage, chemical resistance and application procedures are covered. Tech Bul M-5 — Wisconsin Protective Coating Corporation.

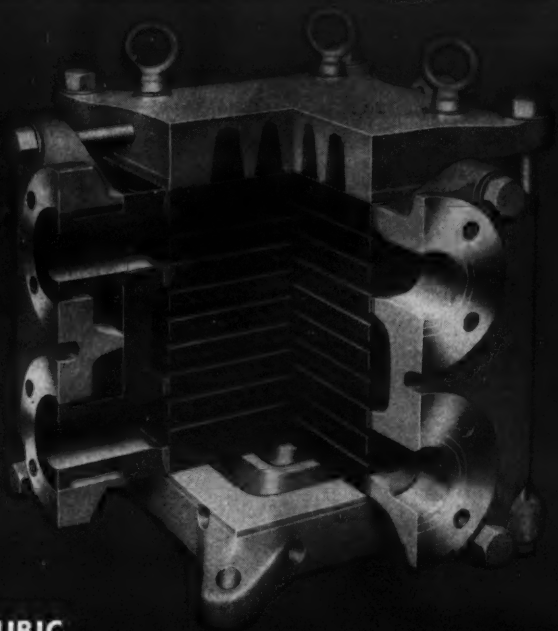
Check 5192 opposite last page.

Design manual for Pyrex-brand modular heat exchangers is available. The 28-page brochure cites characteristics, design, and operation of units and serves as handy reference guide. Numerous charts, tables and drawings are included. Bul PE-33 — Corning Glass Works.

Check 5193 opposite last page.

TAKE YOUR CHOICE from FALLS (FI) INDUSTRIES

RELIABLE CORROSION-PROOF IMPERVIOUS GRAPHITE EXCHANGERS



CUBIC

Requires only 1/8 the floor space needed for comparable size tube and shell type.

CROSS-BORE

(Patented)

Has compact "one piece" heat transfer cylinder. Accepts pressures to 200 psi at temperatures to 400° F. in sizes to 470 ft.² Another exclusive development from Falls Industries.

These exchangers are unaffected by all corrosives except a few highly oxidizing agents — are immune to thermal shock — resist effects of internal and external shock — possess a high rate of thermal conductivity (over five times greater than stainless), . . . and are available at a surprisingly low cost! Write for 32-page Industry-Service report, "Data for Cost Estimation", which provides standards and costs for 16 standard types of impervious graphite equipment.

FALLS (FI) INDUSTRIES, INC.

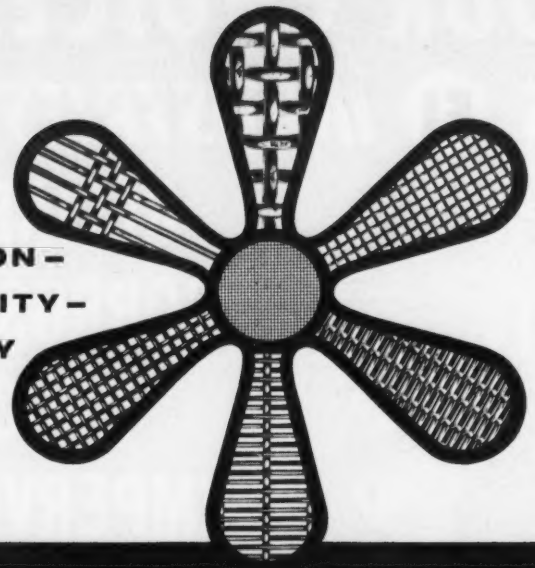
AURORA ROAD SOLON, OHIO

Phone: CHurchill 8-4343 TWX: CGN-FS-720

PRODUCERS OF BETTER PROCESSING EQUIPMENT FROM IMPERVIOUS GRAPHITE

Cubic, Tube and Shell, Cross-Bore, Paralel and Modular Heat Exchangers; Immersion Plate Heaters; Cascade Coolers; HCl Absorbers and Plants; Towers; Centrifugal Pumps, Ball, Control, Drain, Angle, and Diaphragm Valves; Rupture Disks; Pipe and Fittings; Crucibles; Thermowells.

For more information on product at right, specify 5194 see information request blank opposite last page.



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DURABILITY–
ECONOMY

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and STAR
WIRE CLOTH AND SCREEN

* IF your Filtering, Screening or Straining operations are costing you more than they should—
IF the results you want aren't up to expectations—
you need Ludlow-Saylor or Star wire cloth or screen.

Whether your operation involves problems of corrosion, pressure, vibration, heat or abrasion . . . more than a century of experience in precision weaving of the best quality wire available promises the exact screen or cloth to produce a product that meets the toughest specifications.

If one of the hundreds of weaves, meshes and metals in stock doesn't meet your requirements, we can promptly weave precisely what you need. The industry's finest facilities and know-how are at your service. Write for NEW Catalog 105, just off the press.

L-S and Star Cloth and Screens are woven from stainless steel, Monel, bronze, copper, brass, high carbon and oil-tempered steel, and virtually any metal that can be drawn into wire.

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Houston 5630 Harvey Wilson Dr. • Pittsburgh Union Trust Bldg.

STAR WIRE SCREEN AND IRON WORKS, INC.
Sunset Ave. & Valley Blvd., City of Industry (L. A. County), Calif.

Check 5195 opposite last page.

CORROSION control
CHEMICAL PROCESSING

RECENT TECHNICAL PAPERS

Waste disposal, plastic pipe, protective coatings are discussed in condensations of several of the most pertinent technical papers presented at the 17th annual conference, National Association of Corrosion Engineers, Buffalo, New York

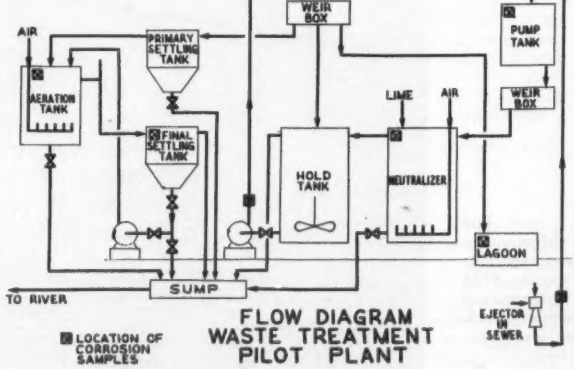
Acceptable construction found for chemical plant waste disposal system

Tests conducted on activated sludge plant, oxidation pond

RANGE of acceptable construction materials for all unit operations of a chemical plant waste disposal facility were determined in a series of tests conducted on an activated sludge plant oxidation pond. A pilot plant installation handled liquid wastes from a major chemical plant along with those of an oil refinery, zinc plant, casting plant and metals reclaiming operation, rubber plant, fertilizer plant and domestic sewage.

Waste was pumped from the sewer, neutralized with lime, pre-aerated and overflowed to a 2000-gallon agitated wooden holding tank. Here wastes were blended and pumped to a stainless steel weir box which controlled overflow to both a primary settling tank of steel and settling lagoon.

From the primary settling tank, the effluent flowed by gravity to an aeration tank of steel. The material later overflowed to a final settler where the biological solids were removed and pumped back to



Flowsheet of activated sludge pilot plant shows location of corrosion samples

RECOMMENDED MATERIALS OF CONSTRUCTION

Unit Operation	Equipment				
	Piping	Valves	Pumps	Tanks	Basin
Raw sewage	A B F G I	A B C D E I L	A B C D E L	A B F G I	F
Neutralizer hold tank, primary settler	A B G H J K	A B C J	A B C J	A G H K	H
Aeration tank final settler	A G H K	A C	A C	A G H K	H
Logoon					F H

Types of Material

A — 316 S.S.
B — Alloy 20 S.S.
C — B 144 Bronze
D — NI Vee Bronze
E — Ni Resist I
F — Polyester, Modified
G — Pine, Treated
H — Concrete
I — Fluorocarbon
J — 304 S.S.
K — Redwood
L — NI-O-nel

the aeration tank for seed. The purified effluent overflowed from the settling tank to the river.

Corrosion Tests

Metallic corrosion specimens were prepared from commercial sheet stock. Sensitized specimens were made by welding two sheets together. All samples were polished to a 120-grit finish and were hand stamped for identification. Non-metallic corrosion specimens were two to three times the area of metal coupons. They were exposed in an "as received" condition. All specimens, except concrete, were electrically insulated and were separated from each other and from their support holders.

All coupons were examined with the naked eye for obvious defects and studied under the microscope at 5X and 40X. Plastic and wood samples were washed with warm water, dried with absorbant paper/cloth and weighed. Concrete samples were washed and examined.

Coupon exposures were made in the pilot plant at eight test stations. Samples were tested in the pilot plant and lagoon from 1409 to 3096 hours; two coupons were exposed in the lagoon for 406 hours.

(Condensed from a technical paper, "Stream Pollution Control — Corrosion in the Biological Treatment of Chemical Process Industry Wastes," by Oliver W. Siebert, Monsanto Chemical Company.)

(For complete information on waste disposal corrosion studies, contact Monsanto Chemical Company, Monsanto, Ill.)

Check 5196 opposite last page.

Plastic pipe systems show top qualities 'on the job'

Corrosion resistance proved in tough service

CHIEF ADVANTAGES of plastic over other types of pipe are excellent chemical resistance; no corrosion externally in fume or spill conditions; low friction loss factor; low installed costs and ease of maintenance; elimination of electrolysis and good insulating qualities. However, thermoplastic pipe has limitations in that it cannot be used at temperatures above 250°F, pressures of about 150 to 230 psi, or in areas subjected to excessive physical abuse.

The more important thermo-

To next page

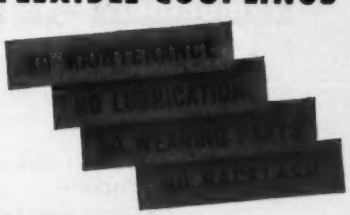
KNOX
OUTSTANDING QUALITY
TOWER PACKINGS
DESIGNED for SERVICE!
Raschig Ring
Single-Partition Ring
Cross-Partition Ring
Berl Saddle
Finest Materials — PLUS — More than 39 Years of Production Experience
√ Modern production techniques assure non-porous tower packings.
√ Uniform quality — high chemical purity — iron free — great mechanical strength — will not crumble.
√ Wide range of designs, with adequate stocks maintained for emergencies.
√ Better Tower Packings at lower operating costs. Prices and samples will be sent on request.
IRON FREE
Always Specify KNOX Tower Packings
KNOX PORCELAIN CORPORATION
KNOXVILLE 1, TENNESSEE

Check 5197 opposite last page.

SPECIFY . . . THOMAS FLEXIBLE COUPLINGS

Think of the losses incurred by maintenance costs, lubrication, down time, damage to connected machines by inadequate flexible couplings.

High degree of accuracy, reliability and performance make Thomas Flexible Couplings the worlds best.



THOMAS FLEXIBLE COUPLINGS

Write for Our New Engineering Catalog 60

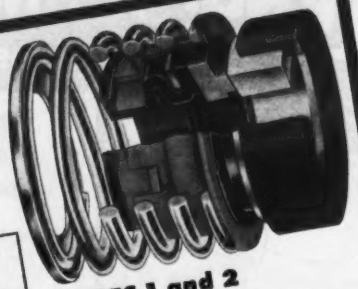
THOMAS FLEXIBLE COUPLING COMPANY

WARREN, PENNSYLVANIA, U.S.A.

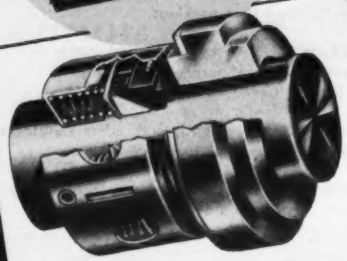
Check 5198 opposite last page.

Reduce your liquid handling costs!

Install John Crane®



TYPES 1 and 2
ALUM SOLUTION
ANHYDROUS AMMONIA
FORMALDEHYDE
LATEX
SODIUM SILICATE



TYPE 9
SULPHURIC ACID
BLACK LIQUORS
SODIUM SULPHIDE
CHLORINE
SULPHITE PULP

MECHANICAL SEALS

There is no better way to cut liquid handling costs than with "John Crane" Seals. They are specially engineered for the Paper Industry to provide these important operational savings:

1. **Eliminating loss of expensive and corrosive fluids.**
2. **Positive sealing of toxics, thus minimizing need for costly exhaust equipment.**
3. **Substantially reduced maintenance and the man-hours involved.**
4. **Reduction of "shutdown periods" due to materially increased service-life expectancy over and above your present methods.**

Ranging from the Types 1 and 2 (for services where synthetic rubber is suitable) to the Type 9 (with sealing members made of DuPont Teflon to handle any industrial chemical or corrosive)... there is a "John Crane" Seal that can be adapted to your individual conditions.

remember: **Your toughest problem can be "John Crane's" next success story.**

Don't wait, call us now. Get our seal catalog.....

Crane Packing Co., 6421 Oakton St., Morton Grove, Illinois (Chicago Suburb).
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John Crane CRANE PACKING COMPANY

Check 5199 opposite last page.

Recent Technical Papers *From preceding page*

plastic materials, from an industrial usage standpoint, follow.

Polyethylene, the largest volume plastic pipe in service today, is flexible and lowest in cost. Higher density polyethylenes exhibit greater rigidity and tensile strength properties.

Acrylonitrile-butadiene-styrene has good impact strength and tensile properties.

Vinylidene chloride (Saran) is used with good success as a lining for metal pipe, which gives necessary physical support.

Polyvinyl chloride (PVC) is most versatile of thermoplastic piping materials. A more advanced type polyvinyldichloride is expected to open new areas of use because of its higher temperature resistance.

Chlorinated polyether (Penton) has broadest corrosion resistance of any of the structural thermoplastic materials but is relatively high priced. It can operate continuously at temperatures as high as 250°F.

Typical Case Histories

Polyvinyl chloride has been used in copper refineries to circulate electrolyte. The aforementioned systems operate at 140-150°F and 25-30 psi. Installations have been in service for more than four years with excellent results and a minimum of maintenance. Cell efficiencies have been improved due to reduction in heat loss and avoidance of metallic contamination.

Flanged rigid PVC pipe is installed at Kermac Nuclear Fuels, Grants, New Mexico

PVC pipe in electroplating plants has proved quite successful, especially in continuous recirculation in larger installations. Purity of delicately-balanced plating solutions is protected.

One eastern food processing company is using PVC pipe and fitting for handling dilute acetic acid. The pipeline was relocated after four years of service and was found to be in A-1 condition internally and externally, even though it had been buried in a cinder bed.

(Condensed from technical paper, "Plastic Pipe Systems for Corrosion Resistance," by Allyn E. Webb, Kraloy/Chemtrol Co.)

(For more details on plastic pipe systems contact Kraloy/Chemtrol Co., 402 W. Central Ave., Santa Ana, Calif.)

Check 5200 opposite last page.

Comparative properties of urethane coatings are outlined

ISOCYANATE COATINGS, commonly referred to as urethanes, are based on material formed by reaction of an isocyanate with compounds containing an active hydrogen. Most commonly used isocyanate is toluene diisocyanate (TDI). It can be reacted with polyglycols, polyesters or oils like castor oil.

Diisocyanate can be converted to a non-reactive product by reacting it with phenol. Isocyanate-phenol product is stable. It is mixed with a polyol and shipped as a single-package paint. Baking at 300°F drives off phenol and isocyanate groups crosslink to form a hard, tough coating. Organic solvent resistance of baked urethane coatings compares favorably with baked epoxy-

phenolics, but is generally inferior in acid and alkali resistance.

Coating Dries in 2 Hours

This group can be subdivided into single-component and multiple-component systems. In one-package types isocyanate has been pre-reacted with a drying oil, like linseed oil, in much the same way phenolic resins are "cooked" with tung oil. The urethane-oil dries within two hours. Chemical resistance is only moderate.

In another one-package system isocyanate is pre-reacted with a polyol. Excess of isocyanate reacts with moisture from air to harden the film. Coatings have a limited use in field application because of varying humidity conditions.

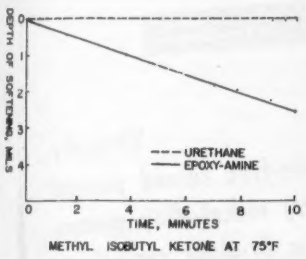


Chart shows comparative attack on coatings during immersion in methyl isobutyl ketone at 75°. Plots are averaged results of two commercial urethane and two commercial epoxy-amine systems

Two-package coatings are shipped as separate components, which are mixed in the field just before use. Pot life varies from one to 48 hours. They are prepared through the use of a variety of materials containing reactive hydrogen groups. These include coal tar pitches and polyols such as castor oil. The newly-applied coating is hard, usually flexible and glossy. Yellowing of the film during outdoor exposure is a characteristic of two-package urethanes.

General chemical resistance of two-package urethane coatings must be classed

In a laboratory test, samples of Garlock 5881 packing were immersed in a 25% nitric-75% sulfuric acid mixture at room temperature. After 8 minutes agitation the samples caused the acid solution temperature to increase but 1.5°F . . . indicating only slight reaction. Increases up to 5°F are considered acceptable for nitric acid service.

ENGINEERED TEFLON PACKINGS

for Chemical Processing

Now . . . another Garlock exclusive! A low-cost blue asbestos packing that resists STRONG acids at temperatures from −90°F to +500°F. It's new Garlock 5881 LATTICE BRAID† . . . laboratory tested and proved to be non-nitrating. A completely new Garlock manufacturing technique combines the blue asbestos with over 30% sintered Teflon* (by actual weight); this adds greater stability under temperature changes and outstanding resistance to glazing. Garlock 5881 LATTICE BRAID** is non-absorbent, with no "wicking"; hence it has minimum swell. Countless bearing points of Teflon powder reduce friction and wear. Retightening or adjustments are rarely, if ever necessary.

Yours at the price of regular packing. Garlock 5881 LATTICE BRAID Packing sells for almost 40% less than other blue asbestos Teflon Packings. Yet, you enjoy all the above features *plus* the advantages of exclusive LATTICE BRAID construction—completely integrated structure for greater strength, longer life, more flexibility and lower maintenance cost. No single outer braid or cover to wear through. Holds together without disintegrating, wears far beyond ordinary packings.

Fast warehouse delivery. Garlock 5881 LATTICE BRAID Packing is immediately available in sizes from ¼" through 1" in either spool or reel form. Call your Garlock representative at the nearest of 26 Garlock sales offices and warehouses throughout the U.S. and Canada. Or, write for Catalog AD-185, Garlock Inc., Palmyra, N.Y.

Canadian Div.: Garlock of Canada Ltd. **Plastics Div.:** United States Gasket Company. **Order from the complete line** of quality Garlock products . . . Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastic Stock and Parts.

†Registered Trademark *DuPont Trademark **Patent Applied For

GARLOCK

Check 5201 opposite last page.

CHEMPRO
SQUARE-BRAIDED TEFLON* PACKINGS

Chempro Square-Braided Teflon Packings are tough, strong and chemically inert. They outlast ordinary braided packing many times over, holding together longer against even the strongest acid, alkali or organic solvent. Here are four popular Chempro Square-Braided Teflon packings:

STYLE No. 480 PACKING
Constructed of pure Chempro tape, braided square without lubrication. For highly corrosive services where a lubricant is undesirable.

STYLE No. 480-F PACKING
Resilient, square-braided packing of Chempro Teflon multi-filament yarn, without lubrication. For pump and valve applications in highly corrosive services where the packing must "give" to a certain extent.

STYLE No. 480-FI PACKING
Square-braided packing of Chempro Teflon multi-filament yarn and impregnated with Teflon suspensoid. This dense packing was developed for gas and vapor services where other lubricated packings were not acceptable.

STYLE No. 480-FL PACKING
Made by square braiding Chempro Teflon multi-filament yarn and externally lubricating with a non-hardening and non-melting lubricant. Recommended for high speed applications and highly corrosive services, from freezing to 350° F.

These Chempro Braided Teflon packings are available in all sizes in standard 1/16" increments from 1/4" to 3/4" square—in spool or coil forms. Can be cut to specific ring sizes, if desired.

Write for revised Bulletin CP-552.

*duPont trademark

CHEMICAL & POWER PRODUCTS, Inc.

[illegible] Broadway, New York [illegible] N. Y.

Check 5202 opposite last page.

among the best of currently available resin types. They are useful in acid, salt, water and organic solvent exposures with resistance characteristics similar to amine-cured epoxies. In strong alkali conditions, performance of urethane systems varies widely with primer used, but is generally inferior to catalyzed epoxies.

Two-package urethanes range from rigid to elastomeric in initial properties, varying chiefly with type of polyol crosslinker used. Properly formulated urethane retains its original flexibility and toughness better than any other class of air-drying thermosetting coatings.

Because two-package urethanes develop a strong chemical bond to oil-containing paints, they are useful for overcoating alkyd and phenolic-oil maintenance coatings. Best formulations of two-package, air-drying urethane coatings compare favorably with vinyl and epoxy coatings for protecting plane surfaces in acid, fume and wet salt exposures indoors and outdoors.

(Condensed from a paper "Comparative Properties of The Major Types of Urethane Coatings," J. W. Cushing, J. D. Byrd and J. F. Montle, Carboline Company.)

(For more details on urethane coatings contact Carboline Company, 32 Hanley Industrial Court, St. Louis 17, Missouri.)

Check 5203 opposite last page.

Versamid-epoxy coatings show high adhesion and flexibility

Corrosion resistance superior under adverse conditions

VERSAMID® RESINS are low molecular weight polyamides formed from condensation of di- or polyamines with dimer acid. They react with epoxy resins at room temperature or at slightly elevated temperatures to provide highly corrosion-resistant vehicles for primers and topcoat paints. Unlike amine curing agents, the Versamids do not present

Liquid handling problems?
Corrosive Vapors at 1300°F No Problem For Nucerite
Bi-metal tubing cuts cost of using Titanium, Tantalum, Zirconium
Virtually trouble-free record posted by nickel-alloy pumps for Zr-plant corrosives
High-alloy trays last three times longer.
Polyethylene pipe assures ferrous-free PVAc emulsions
Find your NEW SOLUTIONS in CHEMICAL PROCESSING
of cooling tower corrosion

problems of skin irritation and toxicity.

Mineral acid inhibition tests, NACE corrosion tests and dynamic corrosion testing indicate that these Versamid resins are excellent corrosion inhibitors. In these tests they compare favorably with accepted commercial inhibitors. In addition, being polymeric, they contribute to structural character of coating vehicles.

Exposure Tests

Coated steel panels were exposed on a tidewater beach near Miami, Florida. Selected panels were in salt water part of each day and in salt air for the remainder of the time.

As expected, corrosion began first at sharp edges, particularly on angle irons. Vehicles containing ester linkages such as oil-based and alkyd-based systems did not stand up under these severely corrosive conditions. Vinyl system was more resistant although not as resistant as the Versamid-epoxy system.

To simulate conditions which might be associated with applications in damp weather, one side of angle irons was brushed with water before the first primer coat was applied. Results showed that Versamid-epoxy system may be successfully applied to a wet surface. Actual use of this system for direct application on sweating penstocks has been recorded.

Adhesion Is Enhanced

When asphalt is added to wet aggregate with mixing, normally, very little adhesion is observed. If, on the other hand, asphalt containing 0.5% Versamid 140 is added with mixing, more than 95% of wet aggregate is coated. This demonstrates resin's adhesive promoting properties.

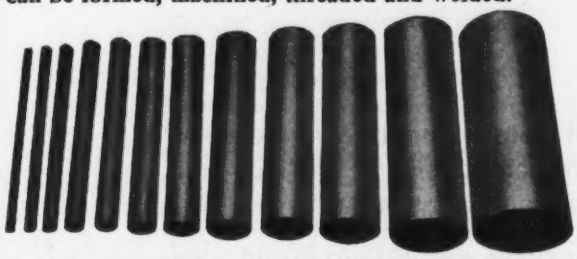
Cured four-mil films of a flexibilized formulation will pass a 90% bend over a two-inch rod at −20°F when coated on ⅛-inch-thick steel.

The Versamid-epoxy system is highly impermeable to moisture and gases. Rate of transmission of water vapor in grams per day for a vinyl

Van-Cor® THE ANSWER TO CORROSION PROBLEMS

WHAT IS VAN-COR? Van-Cor is rigid unplasticized polyvinyl chloride. Available in two types: Van-Cor 1—*Normal Impact* and Van-Cor 2—*High Impact.*

ADVANTAGES OF VAN-COR—Van-Cor is highly resistant to corrosion by hundreds of industrial acids and alkalies. Van-Cor is light in weight (½ that of aluminum). Van-Cor has high tensile strength and low flow resistance. Van-Cor is easily installed because it can be formed, machined, threaded and welded.

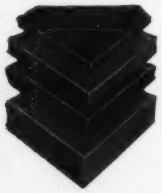


VAN-COR PIPE—Diameter sizes from ¼″ thru 12″. Available in 10 ft. or 20 ft. lengths.

VAN-COR FITTINGS—Sizes from ¼″ thru 12″. Includes: threaded fittings, socket fittings, flanged fittings, belled fittings and special fittings.

VAN-COR VALVES

Sizes from ½″ thru 3″. Types include diaphragm valves, plug valves, lift check valves, ball check valves, ball valves, and Walworth "Y" globe valves.



VAN-COR SHEETS

Thicknesses range from 1/32″ thru 2″. Sheet stock size is 48′ x 96′. Transparent on special order.

VAN-COR EXTRUDED 90° ANGLES

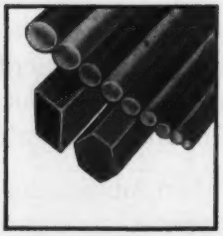
Sizes: 1½″ x 1½″ x 3/16″ and 2″ x 2″ x ¼″. 10 ft. lengths.

* * * *

TUFTITE® PVC pipe is unaffected by sewage or harmful soil conditions. Will not break in storage, installation or use. Roots cannot penetrate Tuftite's bonded joints. Lightweight; easily installed. Tuftite is available Plain or Perforated, 2″ thru 6″ diam., 10′ or 20′ lengths. Tuftite fittings are also available.

VAN-COR JOINING STRIPS

For connecting PVC stock by solvent welding. 90° joining strips for corners, H strips for a single plane. For sheet gauges of 1/8″, 5/16″, ¼″. 10 ft. lengths.



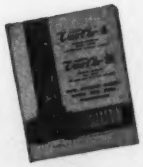
VAN-COR BAR STOCK

Round bars, ¼″ thru 2″ diam. in 10 ft. lengths. 2½″ thru 4″ in 5 ft. lengths. Hexagonal bars, 7/16″ thru 2″ in 10 ft. lengths.

VAN-COR CUSTOM FABRICATIONS

Colonial will fabricate to your specifications hoods, tanks, ducts, tank linings, etc.

OTHER FORMS—Van-Cor is also available in Welding Rods, Bolts and Nuts, Extruded Seamless Duct, Fabricated Duct, and Custom Extrusions.



VAN-COR CATALOG

Request complete catalog containing detailed specifications, diagrams, flow charts, chemical resistance tables and installation data.

Engineering Service Available

INDUSTRIAL DIVISION OF

COLONIAL PLASTICS MFG. CO.

Subsidiary of the Van Dorn Iron Works Co.

2685 EAST 79TH STREET • CLEVELAND 4, OHIO

Check 5204 opposite last page.

film is 0.0261 while the epoxy-Versamid showed 0.0089. Ratio of Versamid to epoxy resin is not highly critical.

(Condensed from a technical paper, "Versamid-Epoxy Coatings — Corrosion Applications," Donald L. Andersen, Don E. Floyd, David W. Glaser, and Harold Witcoff, General Mills, Central Research Laboratories.)

(For more information on Versamid resins contact General Mills, Chemical Div., PO Box 191, Kankakee, Ill.)

Check 5206 opposite last page.

Resin impregnation

From page 61

ber-lined units. Because the wood plates weigh only 65 lb each and the frames 40 lb, their handling is also much easier.

Organic acid slurries are processed as 700 gal batches. This results in about 28.5 cu ft of amorphous-flake filter cake. It is necessary to use 1½ press loads per batch. This is accomplished by making three filtrations for two batches.

A typical filtration cycle takes about five hours. This is broken down as follows: Filtering, two hours; blowing with air, two hours; and cleaning, one hour.

Sulfonated organic amine slurries are made up in 380 gal batches. Cake volume is 19 cu ft. Solids are needle-like crystals, readily filterable. The processing cycle for this material is two hours forty minutes: one hour, filtering; one hour, air blow; and 40 minutes, cleaning.

(Phenolic-resin impregnated wood plate and frame filter presses are product of D. R. Sperry & Co., Batavia, Illinois.)

Check 5207 opposite last page.

(Further information about KP impregnated wood may be obtained from Wood Preserving Division, Koppers Company, Inc., Koppers Building, Pittsburgh, Pa.)

Check 5208 opposite last page.

TyZIN ...a new zinc-rich primer by Stoneware

Tyzin is a self-curing sacrificial metal primer offering excellent resistance, with or without a top coat, to organic and inorganic solvents, fresh or salt water, oils and greases.

A 2-3 mil film (obtainable in a single application) provides an excellent primed surface for all standard Tygon vinyl top coats or for Tygon Series "E" Epoxy.

Tyzin consists of a modified lacquer base into which is blended metal zinc powder to form a blended solution of better than 57% total solids by weight.

Applied by conventional brush or spray application, Tyzin air dries within 15 minutes to a rain and weather-resistant coating. It can be top-coated with any suitable top coat within a few hours.

With excellent adhesion to properly prepared surfaces, Tyzin proves a low-cost self-sacrificing metal primer for top protection from galvanic attack.

For detailed technical data write Coatings and Linings Division, U. S. Stoneware, Akron 9, Ohio.

U. S. STONEWARE
AKRON 9, OHIO

474-G

Check 5205 opposite last page.

POSITIVE CORROSION CONTROL FOR STRUCTURAL STEEL

at 1/2 the average COST

in 1/2 the average TIME . . .

GACOTE

NA-62

MAINTENANCE COATING

Protect your structural steel, tanks, piping, towers against weathering, moisture, chemical fumes and splash with GACOTE NA-62 Maintenance Coating. Provides positive corrosion control—cuts application cost and time in half.

- Minimum Surface Preparation
- Good Adhesion Without Primer
- Easy To Apply—Any Season
- Applies To Damp Surfaces

GATES ENGINEERING CO.
WILMINGTON 99, DELAWARE
PROTECTIVE COATINGS AND LININGS: GACOTE, NEOPRENE, HYPALON, URETHANE, EPOXY, VINYL, NATURAL RUBBER, PENTON

Check 5209 opposite last page.

CORROSION KEYS

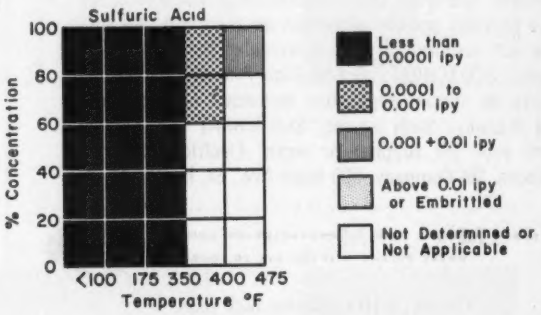
Tantalum

D. O. JONES and D. F. TAYLOR
Fansteel Metallurgical Corporation

"Corrosion Keys" are copyrighted (1961) *by Putman Publishing Company*

THE ACCOMPANYING Corrosion Keys illustrate the resistance of tantalum to various chemical reagents. Data presented here are based on field experience and laboratory tests. Effects of complicating factors such as aeration, galvanic action, contamination and erosion are not considered.

It should be emphasized that these Keys are only for rapid preliminary selection of materials. They are not intended to show what is best for a specific service. The manufacturer should be consulted for further information in regard to a specific application.

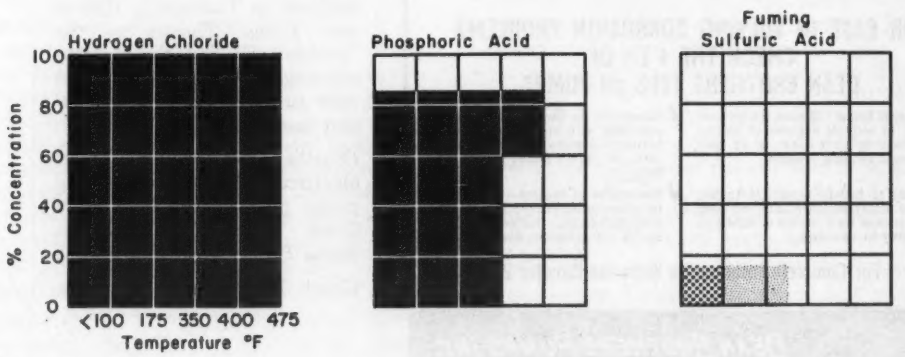


Tantalum with a melting point of 5425°F is one of the most inert of all metals. From a corrosion-resistance standpoint, it is almost the same as glass. For this reason the metal is often used in conjunction with glass and glass-lined steel.

To most acids, weak or strong, hot or cold, tantalum is not merely "resistant," but is actually immune. It is completely inert to acids and salt solutions, either oxidizing or reducing, except HF at all temperatures, and sulfuric or phosphoric acids above 300°F. The metal is attacked by alkali solutions and becomes brittle due to hydrogen absorption.

The outstanding corrosion resistance of tantalum makes it especially useful for fabricating chemical equipment. It has high thermal conductivity and is not subject to thermal shock. The metal is particularly recommended for processes involving chlorine and its compounds, including HCl, or substances containing chlo-

To page 75



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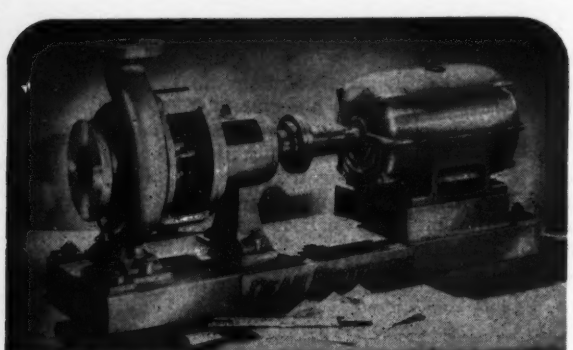
WRAP-ON
RUST PROTECTION
for any metal surface Protect any metal surface from rust caused by fumes, oil, water, caustics, greases and most solvents. This tough polyvinylchloride pressure-sensitive tape provides positive protection on any clean, dry surface and conforms to odd or irregular shapes. Easy to apply, "SCOTCHRAP" Brand Pipe Protection Tape requires no special application technique or equipment and is always ready for use. "SCOTCHRAP" is available from your 3M supplier, or write: Electrical Products Division, 3M Company, 900 Bush Ave., St. Paul 6, Minn.

"SCOTCHRAP" IS A REGISTERED TRADEMARK OF 3M CO., ST. PAUL 6, MINN.

MINNESOTA MINING AND MANUFACTURING COMPANY
...WHERE RESEARCH IS THE KEY TO TOMORROW
3M

Check 5210 opposite last page.



FOR EASE IN SOLVING CORROSION PROBLEMS
CHECK THE 4 E's OF
DEAN BROTHERS TYPE pH PUMPS

- ✓ Easy to Select—28 sizes (14 horizontal, 14 vertical) available in 14 corrosion-resistant alloys, to fit your special pumping problem.
- ✓ Economical to Buy—Low first cost combined with easy servicing and maximum interchangeability of parts make pH pumps lowest cost in the long run.
- ✓ Easy to Install—Centerline suction and discharge connections. No need to remove from suction or discharge piping for servicing.
- ✓ Economical to Operate—Fully open impellers for slurries and clear liquids contribute to long, trouble-free service life with minimum down-time.

For Complete Information Write for Circular 217

DEAN BROTHERS PUMPS INC.
INDIANAPOLIS 7, INDIANA
The Best Is Our Standard

Check 5211 opposite last page.

CORROSION CONTROL

Water pipe 'watchdog'

From page 63

In waterflood operations, the probe is threaded into the side of a water-injection pipe above ground level. Inspectors check for corrosion by testing the probe with a simple circuit tester, such as a one-cell flashlight battery connected to a small bulb.

If no corrosive condition is present, the bulb will light. If too much oxygen gets into the water, the first metal to be pitted and eaten through is the steel ribbon. The rubber band around it has an effect similar to dirt and scale deposits inside pipe and will help set up the flow of ions.

When the ribbon is pierced, the circuit is broken and the bulb will not light. More oxygen inhibitor may then be added to water being injected through pipe, thereby preventing serious corrosion damage throughout system above and below ground. The detection device is then replaced.

Results: The "electrical watchdog" that costs only about five dollars is helping Shell save thousands of dollars. The most dramatic results were obtained at the Joy waterflood project near Wichita Falls, Texas. The installation had been experiencing about 20 pipe leaks per week. During the year following introduction of the spark-plug device, the system developed only one leak!

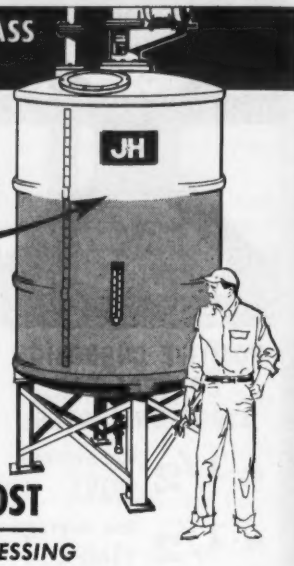
The probes are also being used at major waterflood projects in California, Illinois and Texas. Thanks to the "watchdogs" and the oxygen scavenger, waterflood pipes now produce more crude oil and less corrosion.

(Further information about electrical resistance measuring probe may be obtained from Crest Instrument Company, Santa Fe Springs, California.)

Check 5212 opposite last page.

For more information on developments in the section, check the Reader Service Slip.

J&H FIBERGLASS PLASTIC
TANKS



VISIBLE LEVEL MOLDED-IN GAUGE

MORE-
CORROSION RESISTANT than stainless steel

LESS-
than HALF the COST

for STORAGE & PROCESSING

50 to 70,000 gallon J&H Fiberglass Plastic Tanks are self-supporting. Resist nearly every conceivable chemical. Are glass smooth inside. Require no painting outside. Translucent walls prove flawless construction; permit visual monitoring of liquid level. Eight standard diameters, from 24 inches to 24 feet in nearly unlimited height or length, are mass produced for immediate delivery. Outlets placed to your requirements. Write for brochure and price list.

Also PIPING TUBING & CUSTOM FABRICATION

JONES & HUNT INC. 102 Emerson Ave., Gloucester, Mass.

Check 5213 opposite last page.

Von Arx Air Gun
NEW METHOD FOR
DE RUSTING
DE SCALING
CLEANING

REMOVES WELD SLAG OLD PAINT RUST

PNEUMATICALLY OPERATED
Eliminate weld slag, rust, old paint, clean concrete and rake joints fast and effectively with the VON ARX AIR GUN.

LARGER MODELS AVAILABLE

The VON ARX AIR GUN contains a series of hardened steel needles which adjust to the contour of the surface being cleaned.

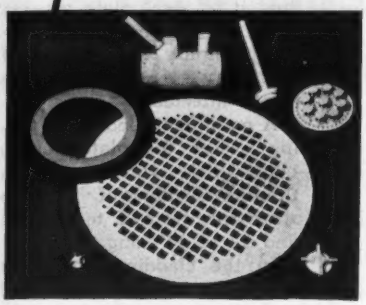
Available in four sizes, there is a VON ARX AIR GUN to fit every job, large or small. For further information or demonstrations, write or call . . .

EASILY CLEANS HARD-TO-GET-AT AREAS

C. J. BREITENSTEIN CO.
8805-5 SHERIDAN DR. BUFFALO 21, N. Y. NF 2-8375
Western States: T. G. CULLEN, 3710 Grand Ave., Dept. 60, Oakland, Calif.

Check 5214 opposite last page.

TEFLON *Specialities*



- Complete line of gaskets
- Precision machined parts
- Special fabrications

Chem Flow has the ability, experience and facilities to produce and supply Teflon products both of a custom nature as well as mass produced items.

The Teflon gasket line runs from simple Pyrex* pipe and flange gaskets through Teflon covered steel adapters; slit and machined envelope and ring type companion flange gaskets; solid Teflon ring, full face and rectangular gaskets; hand hole and manhole gaskets and envelope gaskets for schedule 5 and 10 pipe.

Chem Flow's broad experience in producing Teflon products of this nature means that they have the equipment and ability to handle your small quantity, experimental machining requirements as well as your full production runs.

*T.M. Corning Glass Works

WRITE FOR BULLETIN TS-1

Chem Flow®

CHEM FLOW CORP.
108 Paterson Avenue
Little Falls, N. J.

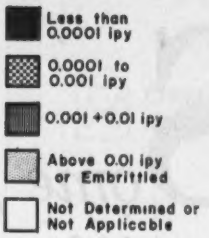
Check 5215 opposite last page.

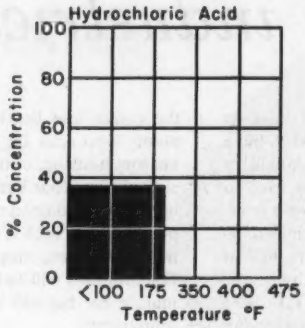
CUT HERE AND FILE

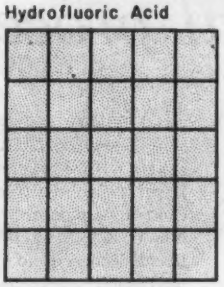
processing and engineering data

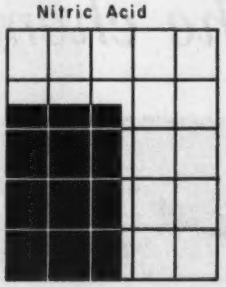
CORROSION KEYS • Tantalum

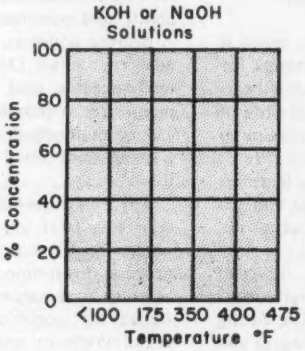
From page 73

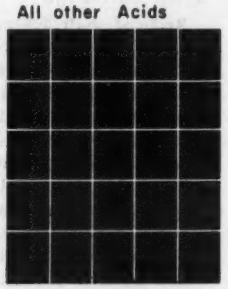


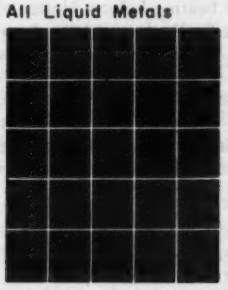












rides or HCl. It is totally inert to wet or dry chlorine, bromine and iodine below 300°F. Even boiling aqua regia does not attack it.

Density: Tantalum is relatively heavy, having a density of 16.6, about twice that of steel. A cubic foot weighs 1036 lb. A piece of tantalum sheet 0.010" thick, 10" wide and 16.7" long, weighs one lb.

Strength and hardness: Unannealed tantalum is comparable to cold rolled steel, while the annealed metal may be compared to annealed steel. Tantalum can be hardened to any degree within range of 150 to 400 Brinell. Young's modulus is 27 million lb per sq inch.

Weldability: Tantalum welds to itself and some other metals by resistance-welding techniques, using spot, butt, projection or seam welds. Excellent arc welds are made by an adaptien of the inert gas method. Tantalum cannot be welded by acetylene torch.

History: Tantalum takes its name from the ancient myth of Tantalus, son of Zeus, who was doomed to the eternal punishment of being tantalized by food and water, just out of his reach. The metal was discovered in 1803 by Ekeberg of Sweden. He named it after Tantalus because he could not succeed in separating the metal from its tightly-locked compounds in the ore. Practical use of the metal was not made until 100 years later.

(Further information about tantalum can be obtained from Fansteel Metallurgical Corporation, North Chicago, Illinois.)

Check 5216 opposite last page.

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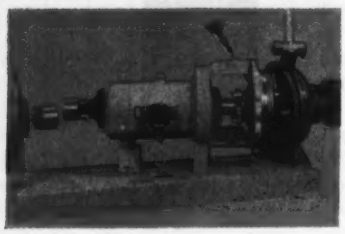
Some fundamentals of centrifugal pump design for the chemical process industries



The primary pump problems in the chemical industry involve materials of construction, gland and seal leakage, and bearing failure. Unless pumps are specifically designed for chemical service, unless materials of construction are selected to handle specific corrosive conditions, unless maintenance is simple and parts standardization is high your pumps may be the biggest headache in your entire operation.

Materials of construction

DURCO has spent 50 years developing alloys and materials for practically any corrosive service.

Pumps and pump parts are available in fourteen standard and many special corrosion resistant alloys. All of these are cast in the Durco foundry to retain complete responsibility for the excellence of your equipment.

Chlorimet 2	Ductile iron
Chlorimet 3	18-8-S (304 s.s.)
Durco D-10	18-8-S-Mo
Durichlor	(316 s.s.)
Duriron	Monel
Durimet 20	Nickel
Durcon (modified epoxy resin)	Ni-Resist #2
	Inconel

Specific design for Chemical Service

Shaft run-out and deflection have been the major causes of seal deterioration, gland leakage and bearing failure in pump operation. DURCOPUMPS have shafts with diameters substantially larger than those traditionally used in centrifugal pumps. Shafts have a maximum run-out of .0015" with centerline deflection of no more than .005" at the impeller under maximum hydraulic load. Bearing housings are a thru-bore design, assuring perfect alignment. With this minimum deflection, packing and mechanical seals last far longer under operating conditions.

Long bearing life

Reduced shaft deflection has made it possible to build Series H pumps for 3500 rpm operation. Heavy duty bearings are selected for a minimum life of two years at this speed under maximum operating stress. The normal life is many times greater than this. Bearings are sealed against oil leakage and external contamination by Durco designed Teflon* lip seals.

Many additional features designed into the Series H Durcopump give maximum flexibility in service. The casing is end suction, top center discharge and self venting with integral feet. Since it uses a rear cover closure, the pumping unit can be removed without disturbing the casing or disconnecting the process piping. *No drilled holes enter the casing at any point.*

Impellers are threaded into the pump shaft, eliminating the impeller nut, and thereby greatly reducing the required NPSH. Head and/or capacity for any pump may be changed merely by changing the impeller diameter. A horizontal seal ring permits adjustment of the impeller without increasing stuffing box pressures.

By the use of an adapter between the casing and bearing housing, eight pump sizes can be mounted on one bearing housing, utilizing one shaft. As a result, just four bearing housings will handle the complete range of Durcopumps. Since each is engineered for the maximum pump size in its range, most Durcopumps will have a built-in safety margin far beyond normal service requirements.

Simplified Maintenance

Simplified, low-cost maintenance results from maximum parts interchangeability and minimum down-time.

Bearing housings, shafts, and frame adapters on all Durcopumps are interchangeable over a wide range of pump sizes. A complete range of pumps can be maintained in your plant with a surprisingly small spare parts inventory.

The foot mounted reverse casing design was first applied to chemical pumps by Durco. This design holds process down-time and maintenance costs to a minimum. Pumps are designed for single trade maintenance. A millwright or mechanic can remove all rotating parts of a Durcopump from the casing in a matter of minutes. Neither the piping nor the motor need be disturbed. This means that rebuilt or new assemblies can be installed with little or no realignment.

Durcopumps are available in sizes from 1" x 1" to 10" x 8" with capacities from ½ GPM to 4250 GPM, and heads to 345 feet. Durco also manufactures self-priming and submerged pumps for most corrosive services.

You will find that your local Durco Engineer is a reliable source of information on pumping problems and equipment.

**DuPont registered trademark*

THE DURIRON COMPANY INC., *Dayton, Ohio / Serves the process industries*

DURCO

Check 5217 opposite last page.

CORROSION CONTROL

Ti-clad steel plate brightens future for titanium

If you have been holding off on using titanium because of high price and difficulties in fabrication, relax . . . cladding it to steel plate can cut costs 25% and at the same time simplify formability. Of course, its corrosion resistance is not affected.

A manufacturer is now taking orders for plates up to 1¼" thick with maximum titanium cladding of ⅜". Plate sizes run from 4 to 8' wide and 12 to 14' long.

In the cladding process, it is necessary that both steel and titanium surfaces be absolutely clean and free from impurities such as oxides and nitrides. Argon gas is used to purge and flush the titanium and steel pack during the six to 10 hour heating cycles before hot rolling.

A four-deck pack of two layers of titanium sandwiched between two plates of backing steel is hot rolled, metallurgically bonding the titanium to the steel. Parting compound between the titanium layers permits separation into two clad plates after rolling.

Bonds produced by this technique have shear strength exceeding 20,000 psi.

(Further information about titanium-clad steel plate may be obtained from Lukens Steel Co., Coatesville, Pa.)

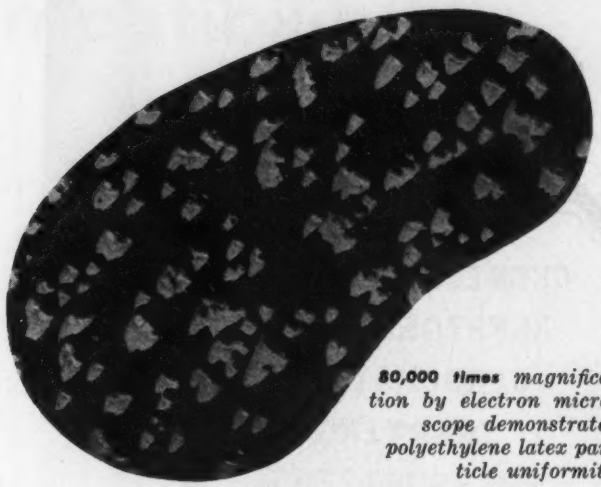
Check 5218 opposite last page.

Corrosion data survey — 1960 edition — has been published. The 8½"x11" hard-cover book contains 99 fold-out charts that summarize corrosion rates of 31 different materials of construction in over 1675 chemical environments. Charts are designed for easy reference and permit feasible materials to be quickly determined and unsuitable ones rapidly eliminated.

Materials of construction are broken down into the following categories: Iron, copper and nickel-base alloys; and other metals and nonmetallic products. Previous editions of the book appeared in 1950 and 1954. Copies of the survey may be ordered by writing direct to Shell Development Company, Division of Shell Oil Co., Emeryville, Calif.

Emulsified polyethylene latex — new base for waxes and polishes

Prime utility beyond floor polish formulations is in textiles to serve as softener in wash-and-wear fabrics and in paper coatings to impart finish resistant to moisture



80,000 times *magnification by electron microscope demonstrates polyethylene latex particle uniformity*

POLYETHYLENE latex is a new member of a family of plastic resins. Offered as an emulsion polymer, this is the first time that polyethylene is available in this form.

Aimed at a number of markets, either alone or in a mixture with commercial polymer latexes, it may be used in surface coatings, textile finishing, polishes, paper treating, printing inks, emulsions for foam rubber and in other fields. Primary market exploitation will be in the floor polish, paper and textile areas.

Two types of "Poly-Em"* are available in sample quantities. They can be made anionic and nonionic by varying the emulsifier used.

Newly-developed latexes are dispersions of very fine particle size containing 40% total solids. They contain polymers which are relatively high in molecular weight and are flexible, yet hard. Compounds are colorless, odorless, non-acidic and resistant to air oxidation.

*Trade-mark of Spencer Chemical Company

PROPERTIES

	ANIONIC	NONIONIC
Particle-size, microns	Less than 0.1	Less than 0.1
% Total solids	40	40
% Emulsifier	4.0 - 6.5	4.0 - 6.5
pH range of chemical stability	Above 8.5	1 - 12
Viscosity: Brookfield 25°C, 60 rpm, cp	(Spindle #1) Less than 100	(Spindle #3) Less than 100
Melting Point (ring-and-ball method, ASTM D36-26), °F	215 - 230	220 - 240
Density, gms/cc	0.92 - 0.935	0.92 - 0.935
Inherent viscosity (0.2% in tetralin @ 130°C), dl/gm	0.5 - 0.9	0.5 - 0.9
Molecular Weight, estimated	15,000 - 30,000	15,000 - 30,000
Color	White	White
Odor	None	None
Hardness: Shore D	45 - 48	45 - 48
Needle Penetration (ASTM D5-52, 300 gms)	1.6	1.6

These materials form adherent, tough, glossy films on paper stock. In the case of the nonionic form, they are good moisture-vapor barriers, and can form very thin films on smooth surfaces with hard, tough, glossy, adherent non-smearing coatings. They are also stable to acids, bases, polyvalent metal cations and vigorous mechanical action.

In the case of the anionic form, continuous films may be cast on glass, on which mixtures with any one of a number of commercial polymer latexes or with a number of commercial levelling agents may be used.

Properties of Latexes

Anionic latexes when treated with acid or polyvalent metal cations will precipitate the polymer.

Nonionic material shows little or no separation of solids occurring after several months storage at room temperature. It is completely stable after one minute of agitation in the Waring Blender at 20% solids concentration. Normally acidic, pH can be adjusted over a wide range, indicating stability to acids and bases, as well as polyvalent metal cations and quaternary ammonium ions.

Film Forming Properties Anionic Latex

These latexes, when spread on paper stock by conventional means and cured above 220°F, form tough, glossy, water-repellent, adherent films which show good heat-sealability to themselves and to extruded polyethylene film. By themselves, they do not form satisfactory films on glass or on glassine paper.

Anionic forms are compatible with a number of commercial polymer latexes. Films formed from such mixtures are more hydrophobic than those containing no polyethylene. Therefore these mixtures are of potential use in applications where increased water-repellent and water-proofing

To next page

properties are needed. High gloss, extremely durable and scuff-resistant floor polish emulsion finishes have been formulated using this form.

When applied to the surface of paper by conventional means and cured above 230°F, tough, glossy, adherent films are formed which exhibit excellent heat-sealing properties. Latex will re-wet the film, allowing double-coating, a condition which results in an excellent moisture barrier.

Both forms are compatible with a number of commercial polymer latexes. However, the nonionic forms are compatible with a wider variety of other latexes than are the anionic forms. This will probably make them the preferred form for paper coating.

(Emulsifiable polyethylene latexes are products of Spencer Chemical Company, Dwight Building, Kansas City 5, Mo.)

Check 5220 opposite last page.

Cost savings possible with tech grade of acetophenone

Substantial cost savings in many non-critical applications should be possible with technical grade of acetophenone. Prices are five cents a pound below those of manufacturer's refined grade and represent savings of about three cents a pound on a contained-acetophenone basis.

Possible areas of use include manufacture of corrosion inhibitors, resins and dyestuffs.

Tentative specifications

Purity, min (% by weight)	97.1
Phenylmethyl carbinol, max (% by weight)	0.2
Styrene, max (% by weight)	2.3
Freezing point, max, °C	17.2
Color, max	25.0
Acidity, max (benzoic % by weight)	0.01

(Technical grade of acetophenone is a product of Union Carbide Chemicals Co., Division of Union Carbide Corp., 270 Park Ave., N.Y. 17, N.Y.)

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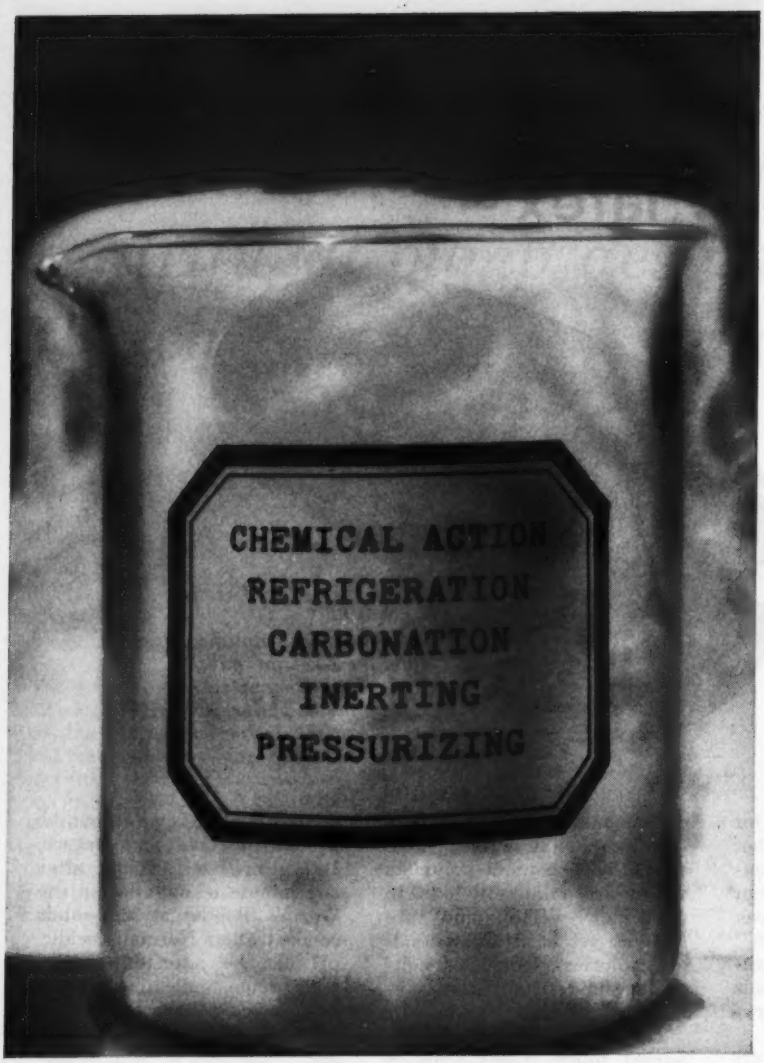


Unlimited versatility MATHIESON CO_2

From the chemistry lab to the shipping platform, Mathieson CO_2 performs numerous vital jobs economically and efficiently. As a liquid or solid, this Jack-of-all-trades is immediately available in any quantity from your nearby Olin Mathieson warehouse. If you'd like more information on the economical use of CO_2 . . . write Olin Mathieson, Baltimore 3, Maryland. A free, informative booklet will be sent to you posthaste. 305

CHEMICALS DIVISION Olin

Check 5219 opposite last page.

Time and Tamms produce the products you need

For half a century we have had the privilege of providing basic ingredients to industry. While we welcome new customers, the great bulk of our business comes from accounts who have been on our books as long as two generations. Tight quality control is a tradition with Tamms, and this policy insures uniformity of product, a safeguard for the quality of your products or processes. We will be delighted to send samples, specifications, and prices.

SILICAS
Amorphous, Diatomaceous and Crystalline

TAMART
Produced and graded special for Metal Finishing Industry

RED OXIDES
Natural and Synthetic grades

MINERAL BLACK

YELLOW OCHRE

CALCIUM CARBONATES
Dry Ground and Water Ground

MAGNESIUM CARBONATE

MAGNESIUM SILICATES
3-in-1 Extender Pigment available in 5 different mesh sizes

SOAPSTONE

CLAYS
Rubber, Insecticide and Paint Grades

BENTONITE

DRY-IT
An Oil-Grease and Water Floor Absorbent, Natural and Calcined Grades

SILICA SANDS

VOLCANIC ASH

PUMICE STONE

WHITE ROUGE

Tamms INDUSTRIES CO.

228 North La Salle Street • Chicago 1, Illinois
Dept. CP-81

TIME TESTED PRODUCTS FOR INDUSTRY

Check 5222 opposite last page.

Epoxidized oil plasticizer has high resin compatibility

First commercially available product of its type to contain 9% or more of oxirane oxygen has greatly improved heat and light stability

PROCESSORS of polyvinyl chloride and other vinyl halide resins can improve properties of the final product by using Epoxol 9-5, an efficient stabilizing plasticizer.

The compound is the first commercially available epoxidized oil to contain a minimum of 9% oxirane oxygen and an average of more than five reactive groups per molecule. It introduces a new level of resin compatibility and a great improvement in heat and light stability. Furthermore, product retains the advantages of older epoxidized oil plasticizers such as low volatility, low extractability and freedom from excessive migration.

Product has high chemical purity, low viscosity and low infrared absorption. Odor and flavor are kept at minimum levels.

Heat stability is demonstrated in the accompanying diagram. Tests show that as little as five parts Epoxol 9-5 PHR about triples the Brabender life of the vinyl formulation shown and also demonstrates greater effectiveness. Curves were run on a formulation of 100 parts PVC, 40 parts polymeric plasticizer, five parts epoxy plasticizer, three parts Ba-Cd stabilizer and 0.6 parts lubricant.

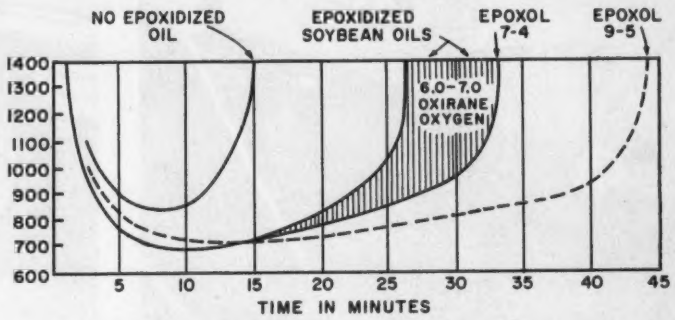
Compatibility Factor High

Proper use of Epoxol 9-5 will not cause spewing or bleeding. Hence high enough levels of Epoxol 9-5 can be used in vinyls so that the compounds may be injection molded and extruded with ease.

Epoxol 9-5 has good compatibility with many resins at the 50% or 100 parts level including alkyds, cellulose acetate-butyrate, chlorinated rubber, nitrocellulose, phenolics (modified), polyvinyl chloride and polyvinylidine chloride. At lower levels up to 10-15% (11-18 parts), Epoxol 9-5 is compatible with additional resins including cellulose acetate, melamines (modified) and nitrile rubber.

(Epoxol 9-5 — available in tank car, tank truck, 55-gallon and five-gallon drums — is made by Swift & Company, Technical Products Department, 1800-165th Street, Hammond, Indiana.)

Check 5223 opposite last page.



Dynamic heat stability at 400° F (Brabender Photograph)

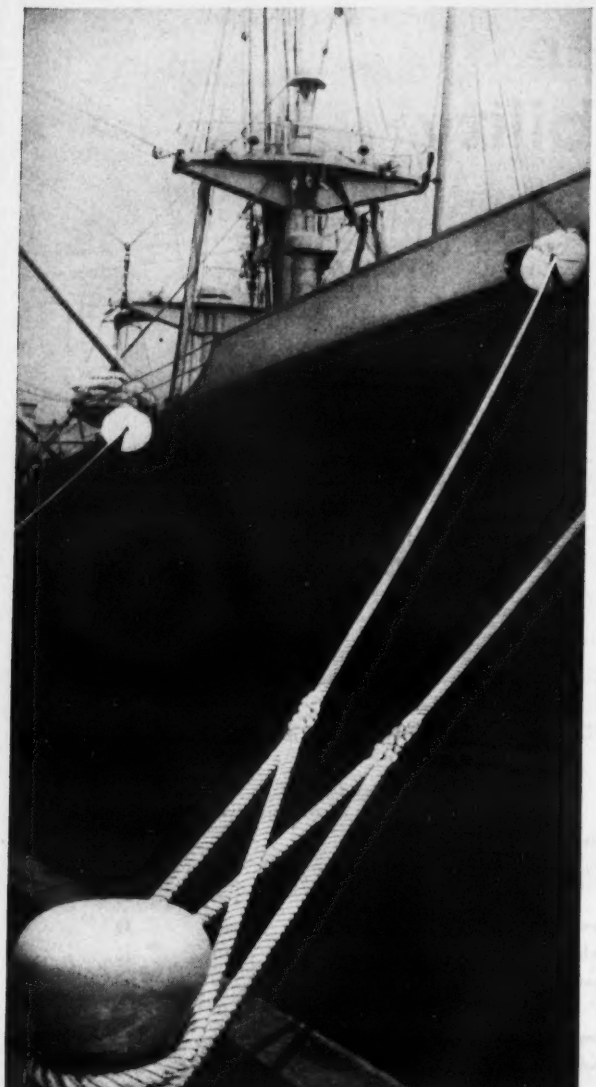
SPECIFICATIONS

Oxirane Oxygen	9% Minimum
Iodine Value	5 Maximum
Color (Gardner)	Less than 1
Viscosity (Gardner) @ 25°C	V Max (8.8 poises)
Saponification Number	176 Maximum
Acid Number	0.3 Maximum
Absorptivity at 2.9 Microns	0.020 Maximum
Specific Gravity @ 25°/25°C	1.020 ± .007

POLYVINYL CHLORIDE FORMULATIONS

Formula	Clear Gen. Purpose	Semi-Rigid Economical	Soft White	Low Temp. Soft Filled
PVC (High Viscosity)	100 parts	—	100 parts	50 parts
PVC (Low Viscosity)	—	100 parts	—	50
Epoxol 9-5	40	40	100	40
Monomeric Epoxy Plasticizer	—	—	—	30
Titanium Dioxide	—	—	10	10
Calcium Carbonate	—	150	—	30
Clay Filler	—	—	40	—
Chrome Yellow	—	—	—	0.2
Chrome Green	—	—	—	0.13
Iron Oxide Red	—	1.2	—	—
Carbon Black	—	0.1	—	—
Mineral Oil	2	2	2	2
Ba-Cd Laurate	2	2	2	2
Liquid Cadmium	1	1	1	1
Org. Chelater	2	2	2	2
Physical Data				
Hardness (Shore A)	85	99	60	62
Tensile Strength (psi)	3100	3200	1800	1700
Elongation (%)	170	140	350	320
100% Modulus (psi)	2550	—	700	800
Specific Gravity	1.33	1.45	1.33	1.35
Color	Clear	Brown	White	Green

HOW *HERCULES* HELPS...



LOWER THE BOOM ON ROPE COSTS—Strong, lightweight synthetic rope made with Pro-fax® polypropylene is now available in a variety of constructions, tailored to meet the specific requirements of every class of marine work. Easy to handle, and highly resistant to moisture and mildew, their long service life results in a much lower cost per ship-operating day than manila.

WHITEWALLS STAY WHITE—Full-strength pine cleaner plus a good rinse mean Sunday-best whitewall tires every day. For many household uses, pine oil in larger quantities makes a triple-duty product—cleans, deodorizes, and disinfects. More than 850 manufacturers use Yarmor® pine oil in products for home and industry.

MAKE BETTER BREAD—Advances in modern chemistry help make "the staff of life" an even sturdier product. Vicrum®, Hercules vital wheat gluten, is now used in many leading specialty breads and baked goods to give better quality, improved grain and texture, longer life.

HERCULES

HERCULES POWDER COMPANY
INCORPORATED
Hercules Tower, 910 Market Street, Wilmington 99, Delaware

CHEMICAL MATERIALS FOR INDUSTRY

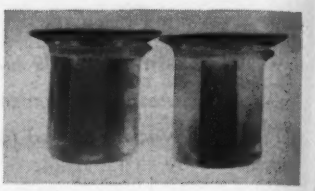
G61-7

Check 5224 opposite last page.

Liquid acid inhibitor forms foam blanket to prevent fuming

Uses: Product is an acid inhibitor for sulfuric, sulfamic, phosphoric or citric acids.

Features: Inhibitor is non-staining and free from objectional odors. During use it provides a thin foam blanket



Mild steel coupons in 15% H_2SO_4 at 200°F. Beaker at left contains inhibitor

to prevent acid fuming and spattering.

Description: Armohib 31 is a 100% active aliphatic nitrogen compound. It may be added to acid bath or it may be added to concentrated liquid acids which can be diluted to the desired strength at point of use. It is effective over a wide temperature range and inhibits pitting action of hydrochloric acid.

(Armohib 31 liquid acid inhibitor is a product of Armour Industrial Chemical Company, 110 N. Wacker Dr., Chicago 90, Ill.)

Check 5225 opposite last page.

Reduce storage problems with a solvent coating non-flammable as liquid

Uses: Product is recommended for coating applications where flammability would be a problem. It should be particularly useful for electronics applications where solvent coatings are used for printed circuits, data cards and components.

Features: Solvent coating is non-flammable in liquid form. It is expected to eliminate special shipping storage and application problems faced by users of solvent type coatings, which are now classified as "red label" materials.

Description: Called Humi-

Seal Type 1B20, it is a single-component, air-drying, solderable, acrylic-base coating. Specific weight is 11.4 lb/gal, solids content 20% by weight. After cure, either room temperature or 30 min at 80°F, coating is rated for maximum continuous use at 270°F. It passes humidity resistance, salt spray and moisture resistance tests given in specification MIL-STD-202A.

(HumiSeal Type 1B20 is product of Columbia Technical Corporation, 24-30 Brooklyn-Queens Expressway West, Woodside 77, N.Y.)

Check 5226 opposite last page.

Fusion temperature lower if plastisols are based on this vinyl resin

Uses: Product is recommended for manufacture of cast, dipped, coated and molded articles. Products can be made by rotational, slush or dip molding; stencil printing on calendered or extruded vinyl sheeting. Resin can also be used as a tie-coat for the lamination of film to fabric.

Features: Fusion temperature for plastisols based on this vinyl resin is 300°F compared to 350°F for plastisols based on other resins. Processing costs are reduced because of lower processing temperatures required since less complex ovens can be utilized. If existing equipment is used, productivity can be substantially increased without equipment modification.

Description: Resin is a polyvinyl copolymer called Geon 135. It can be blended with other resins to lower plastisol viscosity. Current price is 24¢/lb in truck load or larger quantities.

(Geon 135 is a product of B. F. Goodrich Chemical Co., 3135 Euclid Ave., Cleveland 15, Ohio.)

Check 5227 opposite last page.

For more information on developments in the section, check the Reader Service Slip.

Relief Map Copyright Aero Service Corp.

BECCO

H_2O_2

A glance at the map is proof that **only Becco supplies Hydrogen Peroxide from so many distribution points.** The practical result is that you can tie up less money in peroxide inventory—without fear of running out. Just make Becco your "warehouse" for H_2O_2 and other peroxygens.

If you buy in drums, you'll get delivery within 24-hours. Bulk shipments, too, are within one-day delivery, if your plant is located in a 500-mile radius of any major Becco distribution point (red dots on the map). But the fact is, whether you are in northernmost Maine or southern-most California—or **anywhere** in between—Becco deliveries are **prompt.**

For the location of your nearest Becco distribution point, write Department CP-61-20.

BECCO Hydrogen Peroxide

Putting Ideas to Work

fmc

FOOD MACHINERY AND CHEMICAL CORPORATION

Becco Chemical Division

General Sales Offices:

161 EAST 42nd STREET, NEW YORK 17, N.Y.

Check 5228 opposite last page.

Toms River Chemical Corporation's manufacturing complex includes five plants, producing (1) vat dyes, (2) azo dyes, (3) epoxy resins, (4) anthraquinone, and (5) epichlorohydrin

Teamwork Proves the Best Investment in Building This Giant Chemical Complex

Shown above, as they look today, are the manufacturing facilities of Toms River Chemical Corporation* in New Jersey. Once a single vat dye plant, the project has grown into a multi-million-dollar complex of five plants—producing azo dyes, Araldite® epoxy resins, anthraquinone, and epichlorohydrin, as well as vat dyes.

The successful completion of this undertaking, like many others in various parts of the world, was largely the result of Kellogg and client working closely as a team. At Toms River, this teamwork started in 1955 when Kellogg was assigned full responsibility for a new anthraquinone plant, and continued until 1961—when the last of the four new plants went into operation. Throughout this long association, Kellogg functioned virtually as an arm of Toms River Chemical Corporation in engineering, procurement, and construction. In these three areas, Kellogg and TRC specialists pooled their experience and technical know-how to execute best the capital investment for each plant.

Chemical companies interested in expanding their own manufacturing facilities are invited to write for the current 12-page Kelloggram which describes the Toms River chemical complex in detail.

THE M. W. KELLOGG COMPANY

711 Third Ave., New York 17. *A subsidiary of Pullman Incorporated*

The Canadian Kellogg Company, Ltd., Toronto
Kellogg International Corporation, London
Societe Kellogg, Paris
Kellogg Pan American Corp., Buenos Aires
Compania Kellogg de Venezuela, Caracas
Companhia Kellogg Brasileira, Rio de Janeiro

**Toms River Chemical Corporation's parent companies are CIBA Limited, J.R. Geigy, S.A., and Sandoz Ltd.*

Check 5229 opposite last page.

Can cut costs 10-20% when used to replace costly 'high' stearic

Uses: Material can be used to replace premium-grade triple pressed stearic acids in such areas as cosmetics, textiles, plasticizers, pharmaceuticals and paper coatings.

Features: This saturated fatty acid is practically odorless and colorless. It has a high purity and high color stability. Costs savings vary depending on quantities involved and competitive replaced. They can range from a little under 2¢/lb to as high as 4¢/lb, a savings in the area of 10-20%. A food grade is available conforming to all FDA regulations.

Description: Stearic acid is supplied in fine flake form in 50-lb multiwall paper bags, or bulk in tank trucks or tank cars. Process used results in a slightly different mixture of the various natural fatty acids than that produced by conventional pressing, solvent separation and fractionation processes.

Specifications:

	Wilmar 272	High-grade stearic
Color, max (5¼" Lovibond)		
Yellow	1.0	1.0 to 3.0
Red	0.2	0.2 to 0.3
Iodine value (maximum)	0.7	0.5 to 1.0
Acid value	200-206	200-210
Color stability index, max	25	22-40
Titer, °C	58-60.5	55-65

(Wilmar 272 ester grade stearic acid is product of Wilson Martin, Div. of Wilson & Co., Inc., Snyder Ave. & Swanson St., Philadelphia 48, Pa.)

Check 5230 opposite last page.

Hafnium silicides offered experimentally

High hardness, relative ductility, thermal stability and low coefficient of friction exhibited by hafnium silicides suggests their application as a hard facing material. Possible areas of use include valve and

bearing surfaces subject to high loads at elevated temperatures.

Materials are now available in experimental quantities in solid or granular form and can be applied to surfaces by flame or plasma spraying. Hafnium silicides have a density of 10-13 gm/cc @ 30°C. Melting point is 2200-2500°C.

(Hafnium silicides are product of Electronic Materials Corporation, 2200 Colorado Avenue, Santa Monica, Calif.)

Check 5231 opposite last page.

For permanent dry tack, outstanding adhesion, a vinyl copolymer

Uses: Material is suggested for use in adhesive formulations, particularly those for pressure-sensitive and contact adhesives.

Features: Permanent dry tack and outstanding adhesion of material make it suitable for bonding difficult surfaces such as polyethylene and polypropylene.

Description: Vinyl copolymer emulsion provides clear, soft, non-reemulsifiable firms. It is compatible with borax and various organic solvents.

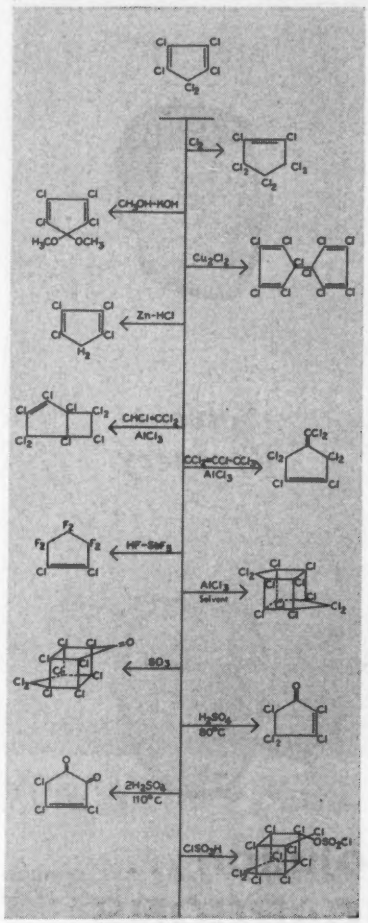
(Vinyl resin D-845 is a product of Shawinigan Resins Corporation, Springfield 2, Mass.)

Check 5232 opposite last page.

"Gentlemen — our new corporate image!"

BRIEFS

C-56® (hexachlorocyclopentadiene)
benzyl chloride
Nialk® trichlorethylene



TAKE ONE GIANT STEP FORWARD WITH C-56®

Work has only begun on tapping the rich field of hexachlorocyclopentadiene derivatives.

Work has only begun, but already we and others have developed some of its acids, acid halides, acid anhydrides, esters, amides, ketones, diketones, quinones, acetals, nitriles and a list of other halogenated hydrocarbons.

Work has only begun, but already C-56 has found its way into various insecticides, fungicides, germicides, nonflammable resins, pharmaceuticals, etc.

Work has only begun, so there's a very good chance that you can take a giant step forward in the development of new products from C-56.

The structural formula tells a lot. Here are a few more specifics: M.P., 9.9°C; B.P., 239°C; viscosity at 100°F: 2.99 centistokes, 5.04 centipoises; free HCl, 0.003%; flash point in open cup none.

There's more data, including a variety of typical reactions and information on handling in a new bulletin we've prepared on C-56 for R & D men. Send the coupon and request Bulletin No. 65.

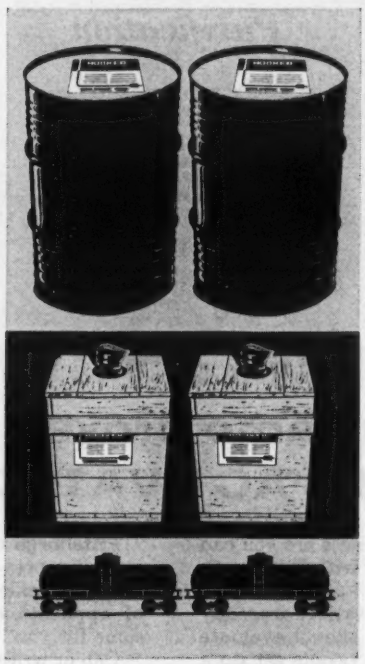
BENZYL GROUPS THE EASY WAY

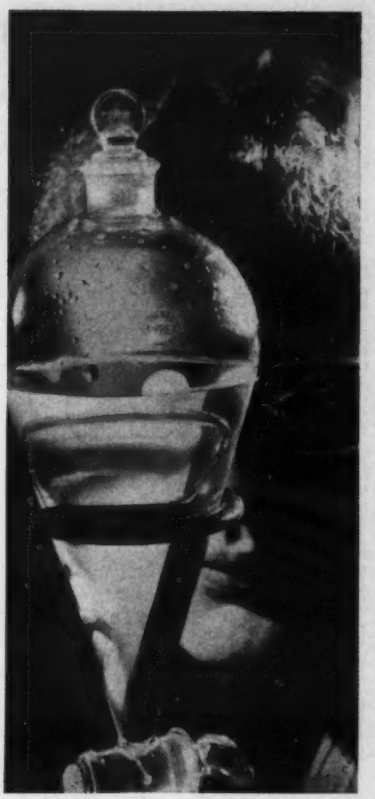
Our benzyl chloride makes a handy source of benzyl groups.

It's insoluble in water but is miscible with both alcohol and ether. Distillation range is 2°C. maximum, including 179.4°C. Its freezing point is −43°C.

Shipment can be varied to make your purchasing, handling, and storage convenient: 13-gallon carboys, 55-gallon iron or nickel drums; bulk in nickel tank trucks or tank cars.

Send for our up-to-date data sheet for specs and other facts.





NIALK TRICHLOR FOR EXACTING EXTRACTION

If you extract vegetable oils, animal fats, and the like, we submit our extraction grade Nialk trichlorethylene for your critical perusal.

This highly pure solvent distills between 86.6 and 87.4°C. It has no acidity, and the alkalinity as NaOH is 0.008% maximum. It contains no free halogen. There is no clouding at −12°C.

Nialk trichlor is a versatile solvent. It makes an excellent nonflammable solvent for adhesives, a dehydrating agent for alcohol, an anesthetic, an organic intermediate, and can control certain chain lengths in polymerizations. It is even used to remove the caffeine from coffee.

Check the coupon, and we'll send you our technical data sheet with specifications on the extraction and four other grades of Nialk trichlor.

For more information check the Hooker chemical you're interested in and mail the coupon with your name, title and company address.

☐ Bulletin No. 65—C-56 ☐ Benzyl chloride
☐ Nialk trichlorethylene

HOOKER CHEMICAL CORPORATION
508 Forty-seventh Street, Niagara Falls, N. Y.

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HOOKER CHEMICALS PLASTICS

Check 5233 opposite last page.

Six common adsorption problems . . .

. . . with the same proven solution . . .

PITTSBURGH ACTIVATED CARBONS

If you have an adsorption problem, chances are you can solve it more *efficiently* and *economically* with Pittsburgh Granular Activated Carbons.

What's more, our Technical Representatives are ready to show you *how*. Without obligation, they'll evaluate your present system . . . or help your people set up a laboratory column to demonstrate the dramatic adsorption efficiency of Pittsburgh carbons.

Pittsburgh coal-derived granular carbons are now at work in scores of continuous column adsorption systems, increasing efficiency and lowering costs in a wide variety of applications. And, chances are, they can do the same for *you!*

Call or write us the details of your adsorption problem today. It's the first big step to an improved adsorption operation in *your* plant. 3278

New! Basic Design Guide for Continuous Column Systems

This new illustrated booklet provides basic design data for planning both liquid and vapor phase continuous column adsorption systems. Write for yours today . . . it's free.

ACTIVATED CARBON DIVISION
PITTSBURGH CHEMICAL CO.
GRANT BUILDING PITTSBURGH 19, PA.
A Subsidiary of PITTSBURGH COKE & CHEMICAL CO.

Sales Offices: Pittsburgh • Trenton • Nashville • Chicago • Houston • San Francisco

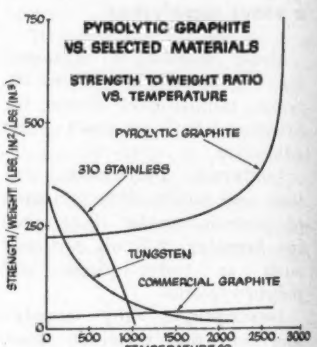
Check 5234 opposite last page.

High temp properties of pyrolytic graphite are exceptional

Measure 60,000 psi @ 5000°F tensile strength

Uses: Low chemical reactivity makes this material a candidate for crucible applications. Its oxidation rate at 1000°C is 100 times lower than that of conventional graphite. Preliminary investigations have been as cladding for rocket and missile nose cones and nozzles.

Features: High temperature strength increases with temperature, rising gradually to 2000°C and rapidly thereafter. Tensile strength has been measured at 60,000 psi at 5000°F.



Strength to weight ratio of pyrolytic graphite compared to selected materials

Description: Pyrolytic graphite is now commercially available in plates, cylinders and special shapes. It is produced as a coating for plain graphite and other materials, or free standing sizes up to 4½ feet in length. Material is produced by high temperature vapor deposition of pure carbon on a graphite or metal matrix.

Carbon atoms are arranged in sheets similar to layer planes in graphite crystals except they are stacked in a disordered arrangement. The sheets or planes are keyed together by wrinkles or cups and are oriented parallel to surface of deposition.

Characteristics are anistropic. In a direction parallel

to planes of deposition properties are similar to metallic. Perpendicular, they resemble properties of non-metallics. Weight is slightly lower than that of aluminum, slightly higher than that of beryllium. Strength-weight ratio is better than 310 stainless at any temperature above 800°F. Like graphite, it has no melting point, but it has a sublimination temperature of 6600°F.

In one direction, material conducts heat better than aluminum and almost as well as copper. In the other direction, its heat insulating value is higher than that of ceramic aluminia. Electrical characteristics are similar, conductive in one direction (parallel) and insulating in the other.

(Pyrolytic graphite is a product of Metallurgical Products Department, General Electric Company, Detroit 32, Mich.)

Check 5235 opposite last page.

See use in polyamides, pesticides and rubber for thioacetic acid

Uses: An intermediate for manufacture of N-mercapto methyl polyamides, synthetic resins, pesticides, esters and additives for rubber and oils.

Features: Reactive intermediate is now available in pilot plant quantities.

Description: Thioacetic acid is now available in minimum 95% purity in development quantities. Treatment with a small amount of thioacetic acid decreases tendency of rubber to crystallize at low temperature without appreciably affecting the brittle point. The carboxyethyl ester is useful as a rubber tackifier. Several phosphorous derivatives have demonstrated insecticidal activity and the arsenic salts of monothioacids act as seed disinfectants. Prices range from $1.65/lb in one-gal containers to $1.25/lb for 55-gal drums.

(Thioacetic acid is product of Stauffer Chemical Company, 380 Madison Ave., New York 17, N.Y.)

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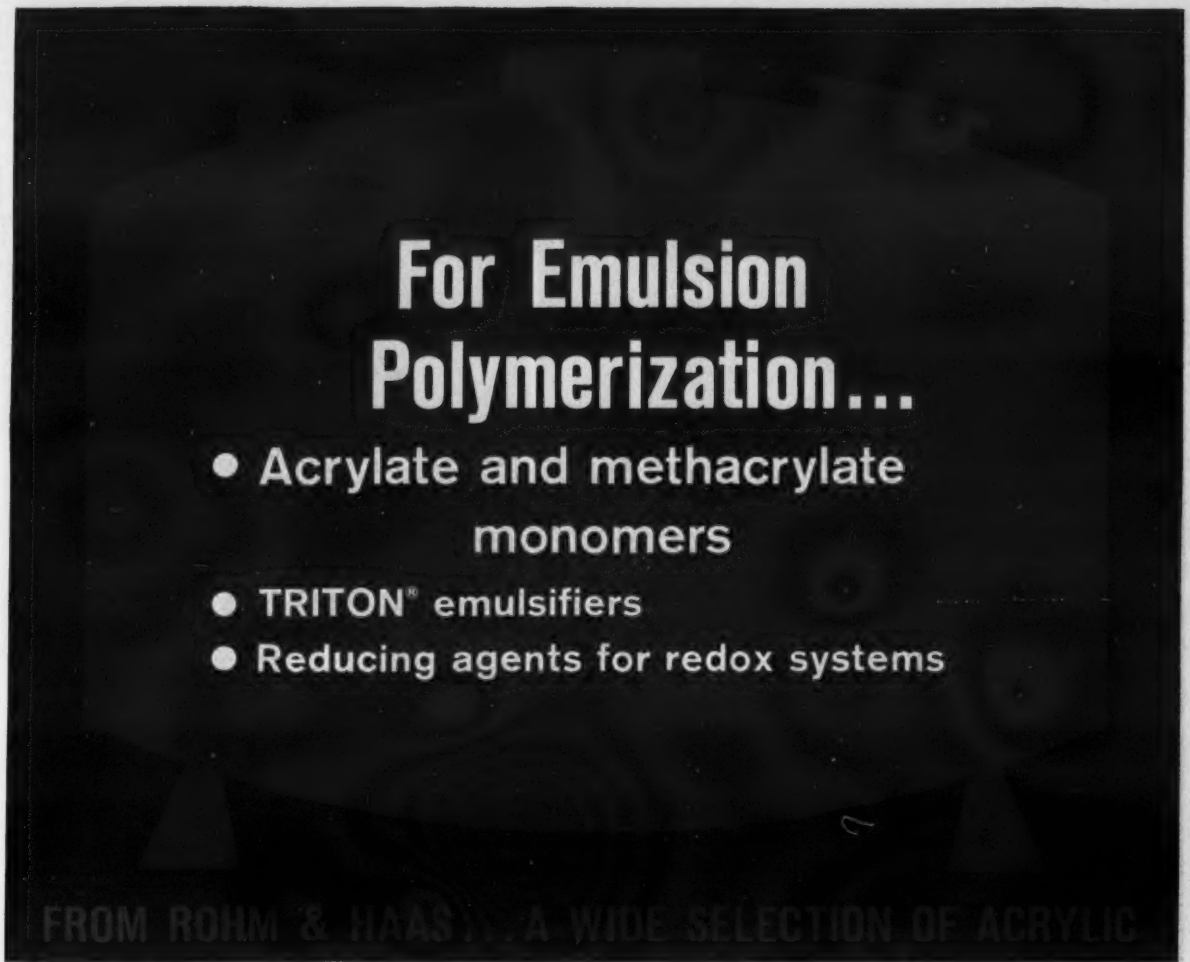
For Emulsion Polymerization...
• Acrylate and methacrylate monomers
• TRITON® emulsifiers
• Reducing agents for redox systems
FROM ROHM & HAAS: A WIDE SELECTION OF ACRYLIC

MONOMERS—PLUS EMULSIFIERS AND CATALYST ACTIVATORS

Rohm & Haas offers convenience—and opportunities for reduced-cost purchasing—to producers of polymer emulsions.

In addition to offering a wide selection of acrylic monomers, Rohm & Haas also supplies: (1) TRITON emulsifiers and (2) LYKOPON® (sodium hydrosulfite), FORMOPON® (sodium sulfoxylate formaldehyde), and sodium thiosulfate reducing agents. Thus, it is possible for you to obtain from one source most of the major raw materials necessary for redox emulsion polymerization. By planning purchases so that these various materials make up a truckload or carload quantity, processors can obtain the low carload price. Also, low bulk prices apply to monomers, emulsifiers, and other liquid products shipped in full compartmented tankcars and tanktrucks.

Rohm & Haas—the pioneer producer of acrylics—also offers assistance in designing storage and handling facilities for acrylic monomers.

Write to Dept. SP-3 for samples of monomers, emulsifiers and reducing agents, and for technical literature on the use of these products in emulsion polymerization.

ROHM & HAAS

PHILADELPHIA 5, PA.

Rohm & Haas Acrylic Monomers used in Emulsion Polymerization

Methyl Acrylate • Ethyl Acrylate • Butyl Acrylate • 2-Ethylhexyl Acrylate • Methyl Methacrylate Butyl Methacrylate • Glacial Acrylic Acid • Glacial Methacrylic Acid

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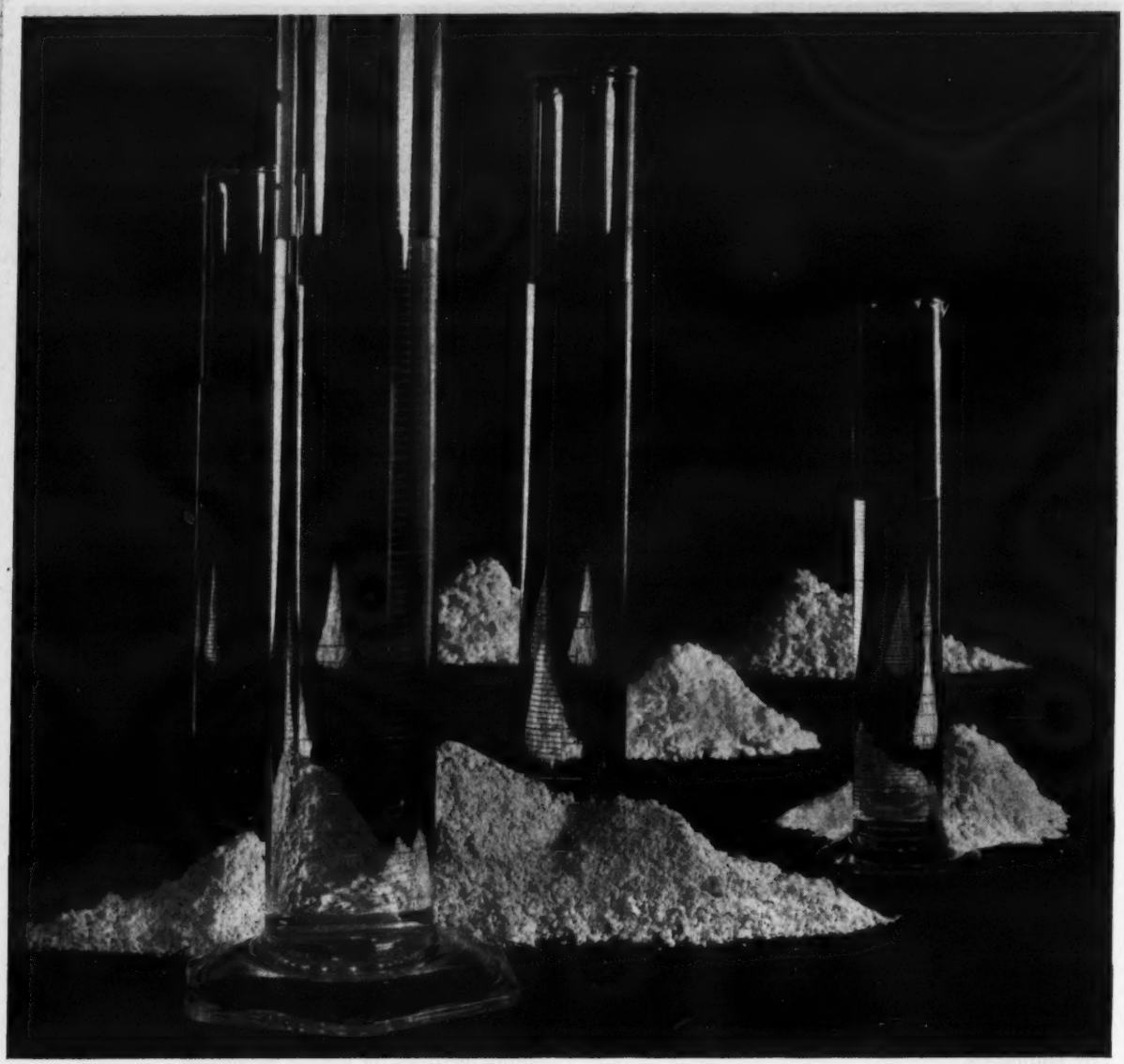


The right grade for every degree of clarity with Celite Filtration

For any filtration problem, there's a Celite® filter aid grade that gives you the exact degree of clarity desired at the fastest flow rate obtainable. Celite is available in many different grades, including special grades for specific applications. No other supplier gives you so wide a choice.

Celite's lower wet density means greater surface coverage, and its higher uniformity provides more consistent results from month to month, carload to carload, year after year.

For full details on how Celite gives the fastest, most efficient filtration at the lowest possible cost write: Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario. Cable: Johnmanvil.

These photomicrographs show the range of characteristics available with Celite filter aids.

JOHNS-MANVILLE

JOHNS-MANVILLE JM PRODUCTS

Check 5238 opposite last page.

Fully flowable amide adds slip properties to polypropylene

Fatty amide, Kemstrene SU, is a dry, completely free-flowing powder which will provide improved slip and antiblock properties to polyethylene and polypropylene films. Product overcomes difficulty found with conventional ole-

Free-flowing fatty amide cuts plastic processing time

amides which were of waxy, gum-like consistency presenting a difficult mixing problem.

This fatty amide flows freely from containers and achieves maximum even distribution over the flakes with minimum mixing time.

(Kemstrene SU is a product of HumKo Products, Div. of National Dairy Products Corporation, 501 Allwood Road, Clifton, N.J.)

Check 5239 opposite last page.

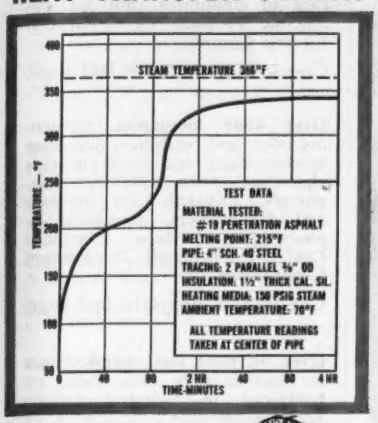
Offer sample quantities of dimethoxybenzoic acid

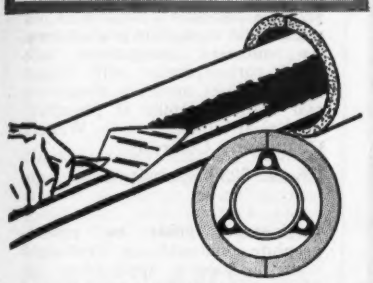
High-purity 2,6-dimethoxybenzoic acid is now available in experimental quantities. Product is used in organic synthesis as an intermediate in the preparation of amides, esters, and alcohols. Specifications include a typical melting point of 186-188°C; 1% maximum moisture content; 10 ppm maximum iron content. Material is supplied as white to light tan crystals.

(Dimethoxybenzoic acid is product of Lithium Corporation of America, 500 Fifth Ave., New York 36, N.Y.)

Check 5240 opposite last page.

Eliminate Asphalt heating problems with THERMON HEAT TRANSFER CEMENT





On seventy miles of asphalt line, some fifty refineries have used Thermon Heat Transfer Cement to eliminate the physical problems and expense of internal tracing and steam jacketing. A non-metallic, adhesive compound with highly efficient heat transfer characteristics, Thermon Heat Transfer Cement used on asphalt lines and equipment

Eliminates stuffing boxes and packing glands

Eliminates the possibility of cross contamination

Reduces considerably both installation and maintenance cost

Eliminates misfitted prefabricated jacketed piping.

Thermon can be used successfully on pumps, valves, pressure and differential pressure transmitters, flow measuring instruments, lab apparatus and pilot plant equipment in service with wax, lube oil, heavy greases, alkylates and #3-#90 penetration asphalt.

For existing or future asphalt installations, investigate the benefits of Thermon, the *proved* solution to heat transfer problems.

Write for Thermon Engineering Data.

THERMON
THERMON MANUFACTURING CO.
1817 Rosine • P. O. Box 1961
Houston, Texas
120

Check 5241 opposite last page.

Black polyethylene resin for extrusion coating has high durability

Uses: Resin is recommended for use in paper-polyethyene combinations for construction and agricultural fields.

Features: Resin is designed for applications where durability, moisture bearer properties and weather-ability are prime requirements.

Description: Regular polyethylene resin is compounded with two and one-half per cent carbon black to provide opacity and improved weatherability. Resin has a base density of 0.923 and a melt index of 3.7. It may be run at temperatures in excess of 75°F without appreciable smoke or odor.

(Alathon 3425 BK 22 polyethylene resin is a product of Polyolefins Division, E. I. du Pont de Nemours & Company, Wilmington 98, Delaware.)

Check 5242 opposite last page.

NEW LITERATURE
Chemical Materials

Sodium aluminate as an aid to sizing and a flocculation agent is described in process bulletin. How the product can improve efficiency in a broad range of papermill operations is graphically illustrated. An insert describes preparation and application methods. Bul P-3 — Nalco Chemical Company.

Check 5243 opposite last page.

Electrical properties chart provides a complete summary of epoxy insulating materials. Complete analyses are presented of electrical as well as mechanical properties. Included are amine as well as anhydride curing agent systems. Bul EP-61-6 — Furane Plastics, Inc.

Check 5244 opposite last page.

Special industrial solvent based on ethyl alcohol is detailed in technical bulletin of four pages. Solvent is formulated for special needs of graphic arts and photographic industries. Bulletin gives properties, specifications and shipping information. Bul ATD 3-261 — U.S. Industrial Chemicals Co. Div., National Distillers and Chemical Corp.

Check 5245 opposite last page.

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NEW SELF-CROSSLINKING COPOLYMER LATEX

A graphic portrayal of the three-dimensional network that is set up during drying of X-LINK 2833, National's new self-crosslinking copolymer latex. This network binds the molecules to one another by chemical bonds and prevents them from flowing past one another upon application of a load.

major improvement in water, solvent and heat resistance

Time again to take a fresh look at vinyl and acrylic properties. National's new X-LINK 2833—a self-crosslinking vinyl-acrylic copolymer latex—substantially improves water, solvent and heat or creep resistance. It also improves film strength. It broadens the scope of practical applications for vinyls and acrylics.

X-LINK 2833 is self-reactive. It crosslinks rapidly upon drying without the addition of thermosetting resins. Eliminates problems of limited stability, odor, compatibility and high curing temperatures usually associated with formulated products.

X-LINK 2833 is suggested for nonwoven binders, wallpaper coverings, asbestos beater addition, paper saturation, vinyl organosol tie coats, adhesive uses, awning coatings, pulp molded products and specialty coatings for textiles and paper. Write for complete technical information.

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CHEMICAL MATERIALS

Silicone coatings for release paper is the subject of 16-page illustrated bulletin. Three emulsions, four solvents solutions, and two controlled release additives are described. Included are techniques for application and evaluation of coatings as well as tips on the care of equipment. Bul S-11 — Silicone Products Dept., General Electric Company.

Check 5248 opposite last page.

Over 4000 inorganics, metallo-organics and organics (including biochemicals) are listed in rare chemicals price catalog. Compounds, primarily for research and development, are listed alphabetically. "Rare Chemicals Cat" — Chemicals Procurement Laboratories Inc.

Check 5249 opposite last page.

Over 40 food and chemical uses for lactose pure milk sugar are contained in technical bulletin giving a complete definition of five grades and numerous granulations. An unbiased comparison with other carbohydrates with respect to solubilities, moisture absorption and melting points, is presented. Technical bulletin L-1 — Western Condensing Company.

Check 5250 opposite last page.

Engineering guide on carbon-graphite materials is concerned with mechanical applications for 18 grades of carbon, graphite, and carbon-graphite. Properties included are apparent density, hardness, elastic modulus, and compressive, tensile and flexural strength. A table of design tolerances is given. Bul S-5425 — National Carbon Company, Division of Union Carbide Corp.

Check 5251 opposite last page.

Water-washed kaolins used as extender pigments receive consideration in technical bulletin which summarizes several years of laboratory research and extensive field trials with these surface modified clays. Tests made and procedures used are outlined. Bul TI-1026B — Minerals & Chemicals Philipp Corporation.

Check 5252 opposite last page.

Over 200 commercially available common organic solvents are comprehensively presented in two-color chart that provides a comparison of their physical properties. Chart includes general definitions of the terminology used, technical data and a detailed breakdown of the physical properties. "Physical Properties of Common Organic Solvents" — The Solvents and Chemicals Group of Central Solvents & Chemicals Company.

Check 5253 opposite last page.

Glossary of 483 organic chemicals is contained in 11-page booklet which includes manufacturer's code number and name in addition to Chemical Abstracts name and the common or trade name for each. Included in the glossary are diisocyanates for the urethane industry and surface active agents. "Glossary of National Organic Chemicals" — Dept. NA 60, National Aniline Div., Allied Chemical Corporation.

Check 5254 opposite last page.

Sterimine technical data sheet describes the use of this trichloromelamine for ion exchange bed sterilization. Toxicity, availability and literature references are also given. "Sterimine" data sheet — Chemical Products Div., Wallace & Tiernan, Inc.

Check 5255 opposite last page.

Eight chemicals in development quantities and 13 chemicals in commercial quantities are offered in folder that invites inquiries on specialty chemicals, "Chemicals for '61" — Ansul Chemical Company.

Check 5256 opposite last page.

Urethane foam catalyst is covered in four-page folder containing physical properties, reactions, suggested uses, stability and safety. Dabco Catalyst Bul — Houdry Process Corporation.

Check 5257 opposite last page.

Morpholine is the subject of a technical brochure with up-to-date data on sales specifications, analytical procedures, handling and storage, physical and chemical properties. It includes a toxicity statement and an extensive bibliography. "Morpholine Bul" — Jefferson Chemical Company, Inc.

Check 5258 opposite last page.

Active grade alumina folder describes chemical and physical properties of this drier and desiccant. Typical chemical analysis and physical properties are given. KA-101 Bul — Kaiser Refractories & Chemical Div. of Kaiser Aluminum & Chemical Corporation.

Check 5259 opposite last page.

Ranging from calcium carbide and pipeline acetylene to organic compounds and special-purpose resins, bulletin of eight pages gives information on structual formulas, physical properties and applications. "AIRCO-Organic Chemicals and Colton Polymers" —Air Reduction Chemical & Carbide Company, Div. of Air Reduction Company, Inc.

Check 5260 opposite last page.

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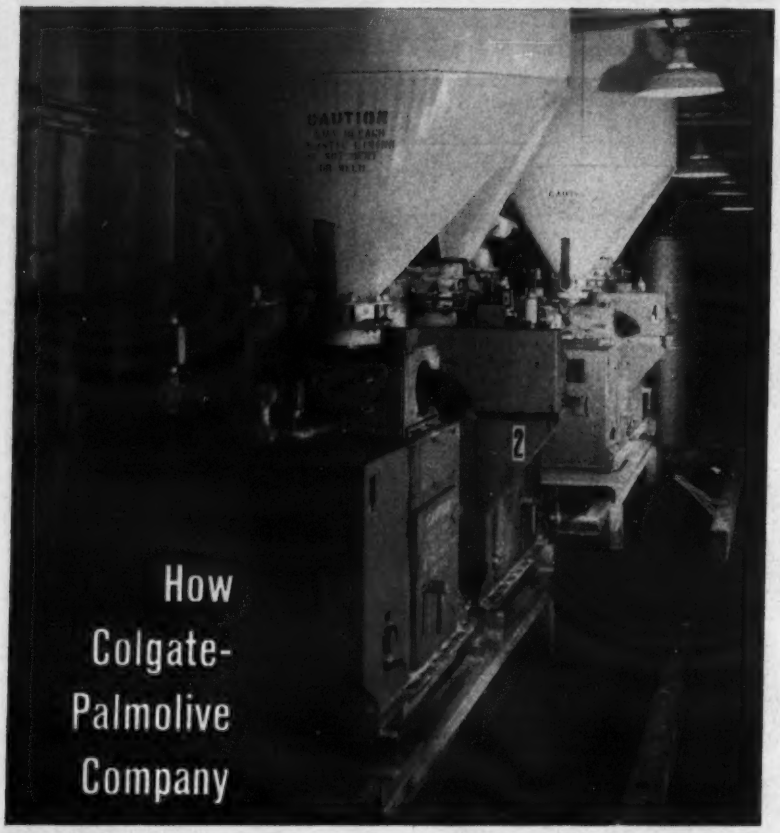

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MATERIALS HANDLING BY WEIGHT SINCE 1902

Check 5262 opposite last page.

Chemical Engineering-Scientist

From p. 29

E Rate relationships
1 Heat transmission
2 Fluid flow of all kinds
3 Mass transfer of all kinds
II—Chemical process principles
A Stoichiometry
B Thermochemistry and energy balances
C Chemical reaction equilibria
D Chemical reaction kinetics
1 Homogenous
2 Heterogeneous and catalysis

"An engineer well versed in these principles will be able to analyze, design, and control any unit operation or unit process which may present a problem to him. He will, of course, always be guided by economic considerations as well.

"He will probably be more flexible and creative in his solution of new problems, be guided more by basic principles and less by an empirical knowledge of the technology which has been used before. He will make fluent use of the appropriate mathematical tools, particularly of numerical analysis with the aid of machine computation.

"Where he cannot afford the effort to unravel the details of a complex mechanism, he will still be content with empirical correlations, but these will be based upon a much sounder use of dimensionless parameters and a clearer understanding of the relative forces and potentials which they represent."

W. H. Corcoran, of California Institute of Technology, has also considered the engineering-science possibilities in chemical-engineering education[8]:

"It is possible to break down the engineering-science approach in the teaching of chemical engineering into six basic fields: material transfer, energy transfer, momentum transfer, chemical equilibrium, chemical kinetics and properties of matter. Certainly the breakdown could be approached from other angles, but the categories given here do suffice for a reasonable discussion of training in engineering science."

Corcoran goes on to point out that a major activity today in the area of chemical engineering-science is the systematizing of the approach to these six fields through the avenues of the basic transfer equations for material, momentum and energy[9].

He explains that, "when combined with the thermal equation of state, caloric equation of state, and boundary and initial conditions, (these equations) allow establishment of pressure, temperature, velocity and concentration distributions in reaction systems."

To a greater or lesser degree, the concepts expressed by these men indicate the direction in which virtually every chemical-engineering department in U.S. universities is headed.

A new engineering-science program, recently initiated at Washington University in St. Louis, is a good example of a curriculum which has changed extensively in the direction of the new thinking.

Required courses for every student include (number of semester-hours given in parentheses): mathematics (15), physics (10), chemistry (5), mechanics and kinetics (10), statistics (3), electricity and electronics (10), thermodynamics (3), materials (3) and drawing (4).

Nine hours of humanities are also required. These include English composition, world culture and humanities, physical education, military science and band. Elective courses may be selected as follows: humanities (18), elective topics in major subject area (30) and free electives (15).

After completing most of the basic courses by the end of the junior year, the student then begins to elect topics in one of the major areas of engineering-science. These areas are applied mathematics, applied mechanics and structures, electronics, environmental systems, human factors, industrial management, in-

strumentation and control, management science, materials, production and transport processes.

A student aiming toward a chemical-engineering career would major in the transport processes. Elective topics in this area include thermodynamics, transport phenomena, heat transfer, fluid mechanics, unit operations, engineering analysis, instrumentation and control, statistical mechanics, chemical kinetics, elements of servo-mechanisms, inorganic technology, organic technology, engineering materials, physical metallurgy, matter and radiation, advanced calculus, nuclear engineering, energy sources and unconventional power sources.

The statements from leading chemical-engineering educators presented on page 27 give an excellent indication of the extent to which the scientization of chemical-engineering curriculum is taking place.

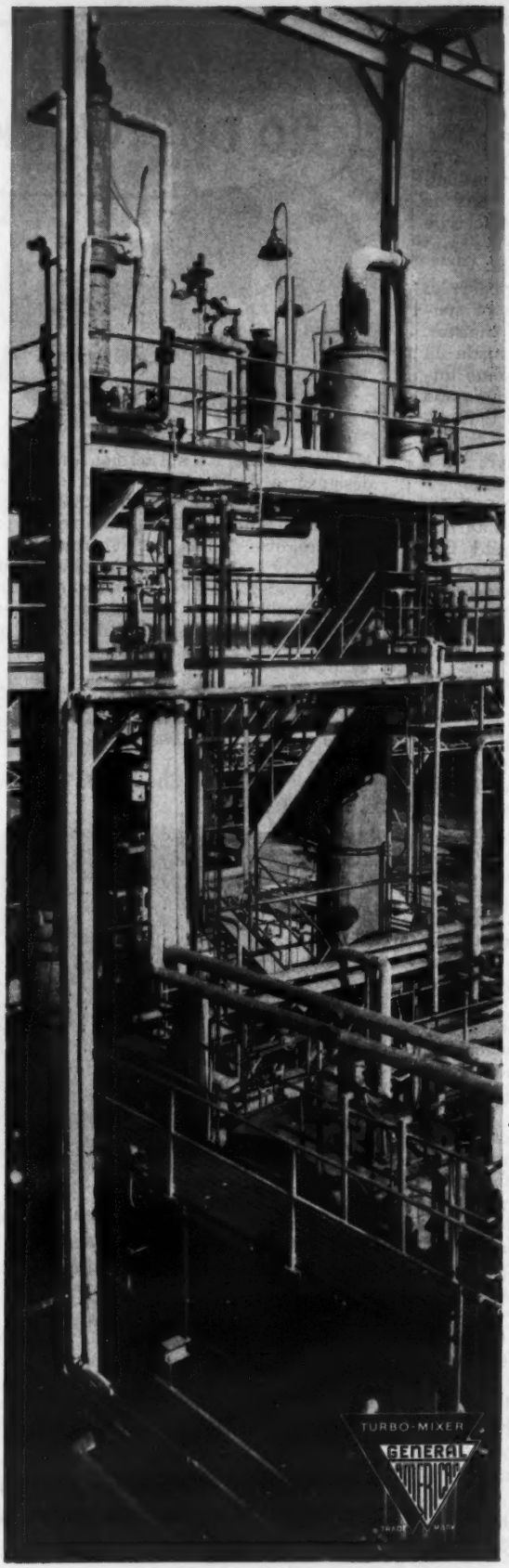
Too Much Too Soon?

As these statements also indicate, the engineering-science revolution in chemical-engineering education is a long way from having the approval of all educational and industrial leaders. Many educators feel that the trend toward elimination of the empirical in chemical-engineering curricula may end up "throwing out the baby with the bath water."

MIT President Julius A. Stratton, for one, feels that the high degree of emphasis being put on mathematical analysis will result eventually in retarded development of the student's other powers of perception. He maintains that it is only through action and experiment that a student learns to observe.

A. J. Teller, professor of chemical engineering at the University of Florida, looks at the problem this way[10]: "The desire to populate our curriculum with the sciences and fundamentals is healthy, and removal of descriptive material concerning practice is to a great degree necessary.

"But deprecation of the



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☐ c) Low power requirements

Answers

1. (C) Rotating Disc Contactor.

2. (B) RDC columns are made for the process industries exclusively by General American, and on a non-exclusive basis for the petroleum industry.

3. (A), (B) and (C). For a complete list of typical systems in service, contact General American.

4. (A), (B) and (C) again. The RDC column is one of the most versatile tools available for extraction processing.

5. (We did it again—all three are correct).

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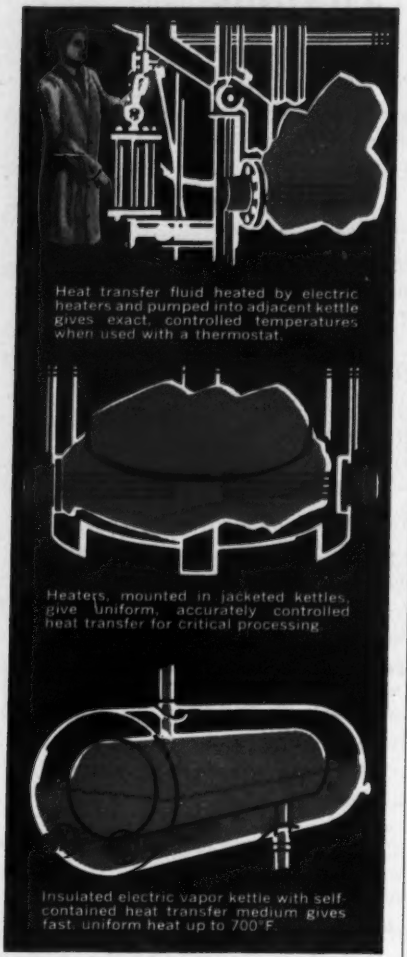

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Check 5264 opposite last page.

Engineering education

From preceding page

objective of the engineer's undergraduate education, the 'why and how to practice,' how to utilize fundamentals, and, yes, empiricism where nothing else is available — this is heresy and a masochistic type of heresy at that." Teller goes on to cite an example:

"A case in point appears in my own chosen area of specialization — mass transfer. Great strides were made in this field by way of some unreasonable assumptions and empirical evaluations that resulted in analysis of single- and two-phase transfers via a steady state mechanism.

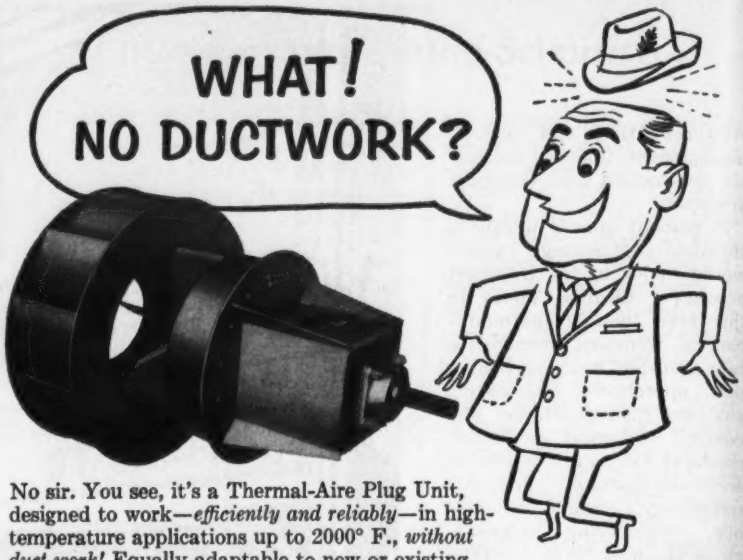
"In 1935, a visionary — may there be many more like him — analyzed the liquid film behavior on the basis of an unsteady state mechanism. Buried and ignored for many years, recently there has been a hurried and intensive series of studies confirming his hypothesis.

"Thus far this theory has not been made applicable to the prediction of behavior of commercial types of equipment. Conceptually it is beautiful — at the present time it can be used as a basis of understanding and for extrapolation — in ten years with much work and study, *it may* be directly applicable to design.

"But, blinded by the glamor of the fundamental, many of our courses deprecate or ignore the old tools, inaccurate as they may be, but which remain the only tools we can *now* use."

Merritt A. Williamson, dean of the College of Engineering and architecture at the Pennsylvania State University, fears "the development of a 'pecking order,' with the highly deductive mathematically-based, heavily research-conscious engineering areas pecking the inductive, empirical, more socially conscious engineering areas.

"With this trend I am certainly not in sympathy. Where is there any authority for such an ordering of professions unless it be in some academic presupposition which derives from an over-glorification of mathematics?"[11]



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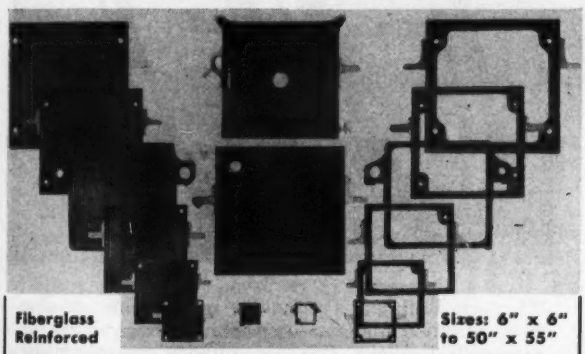

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Check 5268 opposite last page.

A number of major chemical companies are in agreement with this line of thinking. They feel that a man educated in the highly theoretical fundamental approach to chemical engineering is not nearly as well prepared to "produce" for a chemical company upon graduation as is the product of the classical descriptive unit operations chemical-engineering discipline.

These CPI firms are also in agreement that Williamson's fears, concerning the development of intellectual snobbery among scientifically oriented engineers, are well grounded.

Only the future will tell who was right in this controversy. One thing, however, seems certain. For better or for worse, the man of the future in the CPI is the chemical engineer-scientist who speaks the language of the computer and sees chemical processes in terms of material, momentum and energy transfer. ■

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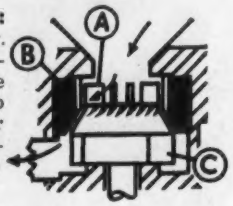

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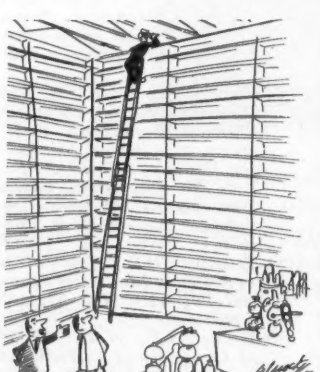

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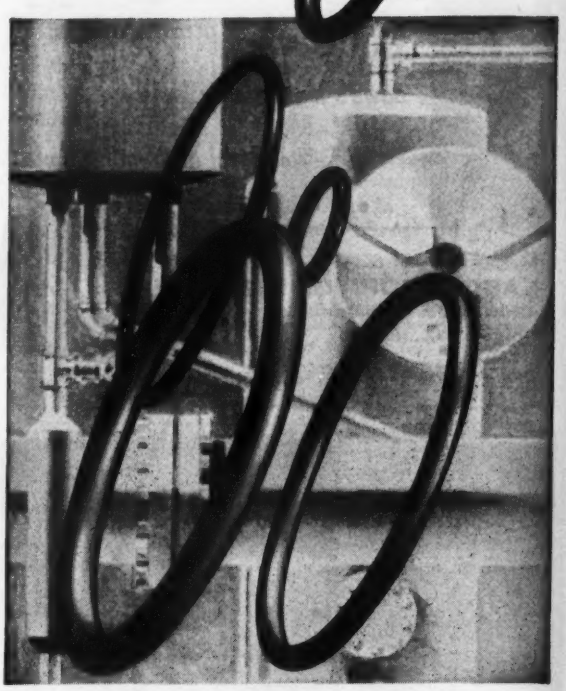

Through Stillman Technology and volume production, Stillman high-quality O-Rings are available at extremely low cost. The same quality and reliability that are engineered into O-Rings for the aircraft and missile industries are also featured in the new Stillman Industrial O-Rings. These all-purpose seals are designed for use in all phases of industrial sealing, and are uniformly high in important features of chemical resistance, low swell, long life, and sealing dependability. Stillman O-Rings are stocked in a complete range of sizes for rapid delivery.

Write for the all-new Stillman Industrial O-Ring brochure, free on request.

NOTE: *Major distributorships still available in some major cities.*

STILLMAN RUBBER COMPANY

Culver City, Calif./Cleveland, Ohio/Englewood, N.J.

Check 5271 opposite last page.

How EVOP works

From page 24

the size and general nature of the process mean little to successful application of evolutionary operation. TEC has used EVOP on large and small scale continuous processes and large and small scale batch processes. To use EVOP on a continuous process, enough time should be allowed for the process to settle down after each change in operating conditions. Then one or more observations should be taken before a new change in the conditions is made. The results obtained should be treated just like the values obtained from batch processes.

This does not mean that EVOP has proved itself a shining knight each time it was dispatched to slay the dragon named process inefficiency. However, never has any failure been the fault of EVOP technique — always there was a fault in applying the technique.

Costs Company Little

Some problems have developed because the high and low levels of factors were set too far apart, allowing major unforeseen changes to occur. Other times the high and low levels were set too close together, so close that change could not be measured in a reasonable length of time. In at least one case at Tennessee Eastman, EVOP was used on a process that, it turned out later, was not in statistical control to start with. Even in the rare cases of misapplication of the technique, EVOP-controlled processes cost the company little: $200 in one case, $100 in another. But the $25,000 annual saving described earlier is typical of successful EVOP.

This saving resulted from an evolutionary operation that ran almost as well in practice as the paperwork said it should. The process involved a high-cost, high-quality organic chemical made on a short run basis. The EVOP committee chose two factors and levels at which to evaluate them. The committee suggested that the yield response

from siding to silo • from bulk to batch
KENNEDY complete pneumatic conveying systems

All manner of powdered and granular dry chemicals are moved quickly, easily and economically by KENNEDY Systems.

FOR EXAMPLE . . . carbon black, cement, clays, detergents, dolomite, fertilizers, fire clay, fly ash, flour, Fuller's earth, hydrated lime, lump lime, petroleum coke, pharmaceuticals, phosphates, pulverized coal, sand, silica, soda ash, synthetic resins, talc and trisodium phosphate.

This system has no high speed moving parts, no screws, no gears, no chains; lubrication and maintenance are practically eliminated; dust control is simpler; costs are lower; worries are fewer.

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Check 5272 opposite last page.

What Really Happens Inside the Bucket

Exploding a widespread misconception of the operation of inverted bucket steam traps

In describing the operation of the inverted bucket trap many well meaning people—and some not so well meaning; i.e., competitors—refer to the need for a "bucket full of steam" to close the trap, and a "bucket full of condensate" to open the trap. The implications of these requirements are many. Sometimes they are contradictory. Often they are misleading. Observations of a trap with a glass body and a glass bucket plus trap design considerations tell the true story.

* * *

In a well designed inverted bucket trap (Armstrong, naturally) the bucket will float and close the valve when it is *no more than two-thirds full of steam.* For example, the bucket in an Armstrong No. 812 trap is $3^{15}/_{16}$" deep. It will float with only 2" of steam.

Good design also dictates that the maximum test opening pressure of a trap should be well in excess of the maximum working pressure for which the trap is furnished. For example a No. 812 trap for 100 psi with the bucket filled with cold water should open at a test pressure of at least 165 psi. Therefore, the bucket does not have to fill completely with condensate to open at 100 psi. The entrance of 1.20" of condensate will cause the bucket to sink. .8" of steam remains at the top of the bucket at the time it is heavy enough to open the valve at 100 psig and with no back pressure.

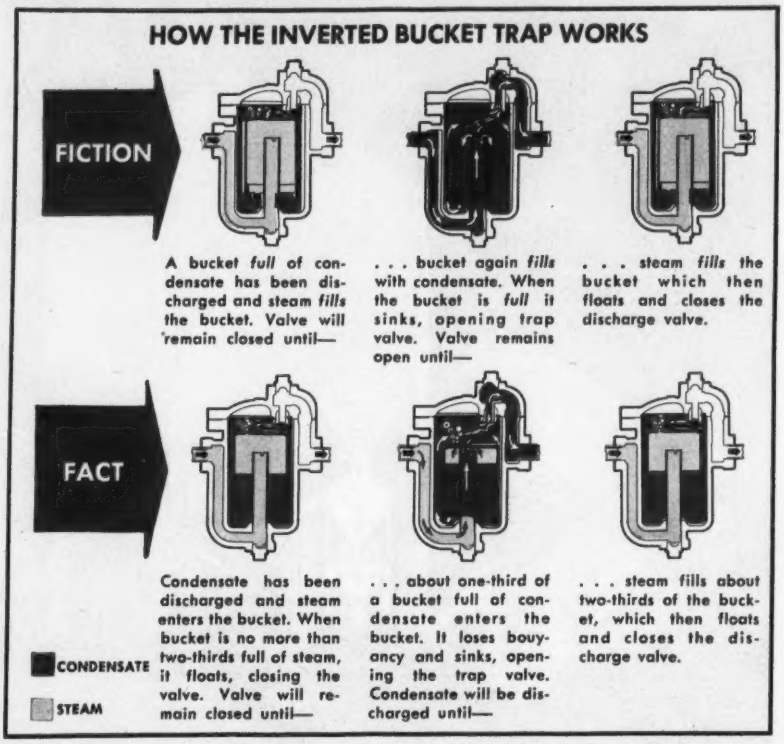
Thus the opening and closing of a 100 psi trap with $3^{15}/_{16}$" deep bucket is controlled by a change in the water level of only 1.20".

In actual practice the 100 psi trap may be draining a steam main in which daytime pressure is only 30 psig. Instead of requiring a 1.20" rise in bucket water level to open the trap against this pressure, the bucket will be heavy enough to open the valve as soon as the water level in the bucket has risen about $^{3}/_{16}$".

Obviously, it does not "take a bucket full of steam" to close the inverted bucket trap, or a "bucket full of condensate" to open the trap.

What's the Significance?

As illustrated above the opening of an Armstrong Trap requires the accumulation in the trap of less than one-third of a bucket full of condensate. This assures good operating characteristics for the vast majority of services by discharging small accumulations of condensate as soon as they reach the trap. It also assures


HOW THE INVERTED BUCKET TRAP WORKS
FICTION
A bucket full of condensate has been discharged and steam fills the bucket. Valve will remain closed until—
. . . bucket again fills with condensate. When the bucket is full it sinks, opening trap valve. Valve remains open until—
. . . steam fills the bucket which then floats and closes the discharge valve.
FACT
Condensate has been discharged and steam enters the bucket. When bucket is no more than two-thirds full of steam, it floats, closing the valve. Valve will remain closed until—
. . . about one-third of a bucket full of condensate enters the bucket. It loses bouyancy and sinks, opening the trap valve. Condensate will be discharged until—
. . . steam fills about two-thirds of the bucket, which then floats and closes the discharge valve.
CONDENSATE
STEAM

frequent opening pressure drops to break up air and condensate films on heat transfer surfaces and thereby maintain high heat transfer rates in the unit being drained.

Additionally, the fact that no more than two-thirds of a bucket of steam is required to float the bucket means that there will always be a generous water seal at the bottom of the bucket. In the case of the No. 812 trap described above, it will be 1.8" deep. This insures that no steam can leak from the bottom of the bucket. More importantly, the bucket can float to close the valve even when the bucket is not completely submerged in condensate.

A Proven Principle Engineered Up to the Minute

While the inverted bucket concept for steam traps is half a century old, today's Armstrong inverted bucket traps incorporate design considerations unknown 50 years ago. The inverted bucket of the Armstrong trap, for example, is not just an upside down bucket. It is a carefully sized, weighted and vented component of a steam trap mechanism that experience proves will do its job right. Throughout, Armstrong design has kept pace with technological advancements, modified when necessary to meet changing requirements.

We do not claim that Armstrong Traps will do every single job better than any other trap. But we do believe it will do more jobs better and more consistently than any other trap. More important, though, for most services, Armstrong Inverted Bucket Steam Traps enable you to get more efficient steam utilization with minimum problems.

We're so sure of what Armstrong Traps can do that we unconditionally guarantee that they will satisfy you. You are the sole judge, too, so there's practically no risk.

* * *

The 48 page Armstrong Steam Trap Book describes other Armstrong features. It also discusses trap selection, installation and maintenance. Ask your Armstrong Representative for a copy or write: **Armstrong Machine Works, 8802 Maple Street, Three Rivers, Michigan.**

ARMSTRONG STEAM TRAPS

See our Catalog in Chemical Engineering Catalog

Check 5273 opposite last page.

How EVOP works

From preceding page

be observed, wrote an experimental work sheet and got it approved.

In this process, a chemical is added to the batch, and the resulting reaction produces the desired product as well as an acid, which is neutralized after a given length of time. The time effect of acid exposure was unknown. One factor chosen for observation was the time from the beginning of the addition of the chemical that produced the acid to the time of neutralization.

The acid-producing chemical had been added at the rate of 120 pounds per batch. The optimum weight of chemical necessary for reaction was not known. The second factor to be studied was the weight of the chemical used.

Accompanying figure shows the way the Tennessee Eastman information board looked at the end of the fourth phase of the experiment. At this point the amount yield per batch had been improved from 562 lb to 588 lb shown at center point at right portion of figure.

Has Own Vocabulary

Evolutionary operation has its own vocabulary, as demonstrated in the preceding paragraph. A cycle is a single performance of a complete set of operating conditions. A phase is the repeated running through of a cycle. In EVOP, a new phase begins when new conditions are studied. These new conditions may be different levels of the previous variables, or different variables. These definitions imply, and properly so, that EVOP is a statistical technique in which the between-block (cycle) variation is measured, while the within-block (cycle) variation is not measured.

Idea Developed in Britain

As indicated, evolutionary operation was developed by Dr. George E. P. Box. He first published when he was at Imperial Chemical Industries, Ltd., Dyestuffs Division Headquarters, Manchester, Eng-

land. (He is currently with the Mathematics Research Center, U.S. Army, University of Wisconsin.) His first paper on EVOP, in 1957, was "Evolutionary Operation: A Method for Increasing Industrial Productivity." *Applied Statistics*, Vol. 6, No. 2, pp. 3-23. The shortage of professional level chemical industry workers in Great Britain and the U. S. perhaps explains some of his motives for pursuing the technique. As editor Donald G. Beech pointed out in *Applied Statistics*:

"The rate at which industrial processes are improved is limited by the present shortage of technical personnel. Dr. Box describes a method of process improvement which supplements more orthodox studies and is run in the normal course of production by plant personnel themselves.

"The basic philosophy: Industrial processes should be run so as to generate not only product, but also information on how production can be improved."

This is the philosophy volunteered at the first meeting with almost any EVOP practitioner — "Don't just get product from a process, get information too." ■

WANTED:

To Keep You Alive

Almost everyone knows of some tricky unexpected danger situation in his plant. CHEMICAL PROCESSING feels that the dissemination of such information to readers is important. Therefore a monthly series on Chemical Boobytraps is now appearing in the Engineering and Safety section. (See page 120) If you know of any such situation, please forward an account of it to:

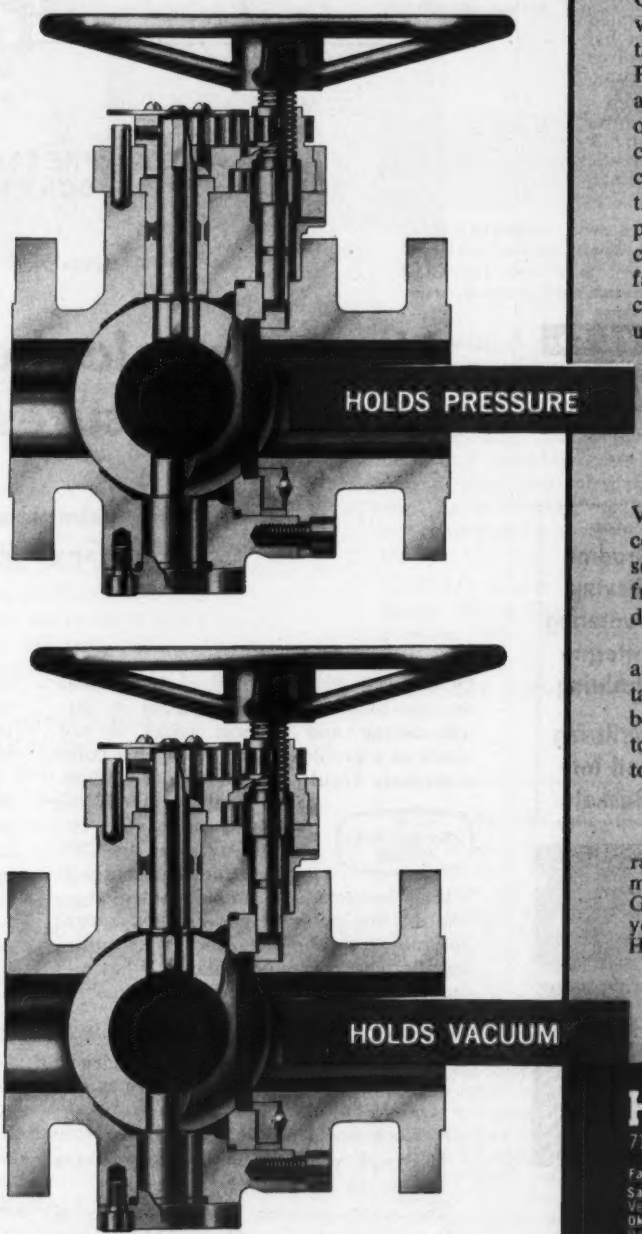
Safety Editor

CHEMICAL PROCESSING

111 E. Delaware Place

Chicago 11, Illinois

Exclusive Controlled Compressible Port Seal provides fast, positive shutoff in any service...



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BALL PLUG Type "K"

VALVES

Controlled sealing . . . a new concept in valve design . . . is the secret of Hydril's tight, bubble-proof shutoff. Hydril Ball-Plug Valves always seal positively against pressure from either direction—or against vacuum—because the fully confined packing ring is mechanically compressed between plug and seat when the valve is closed. This tightly compressed gasket type seal easily bridges clearances between parts as well as surface imperfections. Result: seal efficiency is unimpaired by prolonged hard usage, by rust or sediment.

Design of Hydril Type "K" Ball Plug Valves assures minimum maintenance costs. Non-lubricated, they employ no sealing lubricants. There's no sliding friction between plug and body to produce wear and abrasion.

The spherical plug is mounted on accurately positioned bearings, maintaining a minimal controlled clearance between plug and body. This contributes to easy, free-turning operation as well as to long service life.

●

Hydril valves are available in a wide range of sizes and ratings. Worm-gear and motor-operated models can be supplied. Get the full story on Hydril Valves from your nearby representative . . . or write Hydril Company for free Catalog No. V-60.

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Check 5274 opposite last page.

Specify Sinclair-Collins diaphragm-operated valves to control up to 6000 psi water or hydraulic fluid at high flow rates. S-C valves provide positive, fast control, tight sealing, compact size and ample safety factors.

Sizes range from ½ to 2 in. NPT, aluminum bronze billet bodies, pipe mounted, 2- and 3-way types, remote or direct electro-pneumatic control. Call your Sinclair-Collins Field Engineer today.

For more information, write for free Bulletin S-C 59. Address Sinclair-Collins Valve Company, Akron 9, Ohio, Dept. CP-861.

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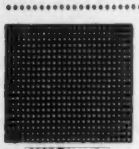
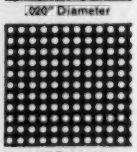
DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)
AKRON 9, OHIO

Check 5275 opposite last page.

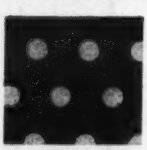
H&K Perforated Screens

for Grading Sieving Dewatering Filtering Straining • Sterilizing and Tote Baskets


.020" Diameter


.045" Diameter

.029" x .129" Slot


Tapered Round Holes in Steel

No. 3 Diagonal Slot

H&K perforated screens are furnished, to customer order, with holes accurate and uniform in size, shape and spacing. The screen resists blinding as burr-free holes are slightly larger at the bottom. H&K perforated screens can be furnished with margins or unperforated areas in practically any material desired.

H&K specializes in the perforating of stainless steel, monel and other corrosion-resistant alloys.

FIND NEAREST H&K AGENT in the 'Yellow Pages'

Listed Under "Perforated Metals"

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Write for H&K General Catalog

Harrington & King PERFORATING CO. INC.

Chicago Office and Warehouse 5636 Fillmore St., Chicago 44, Ill.
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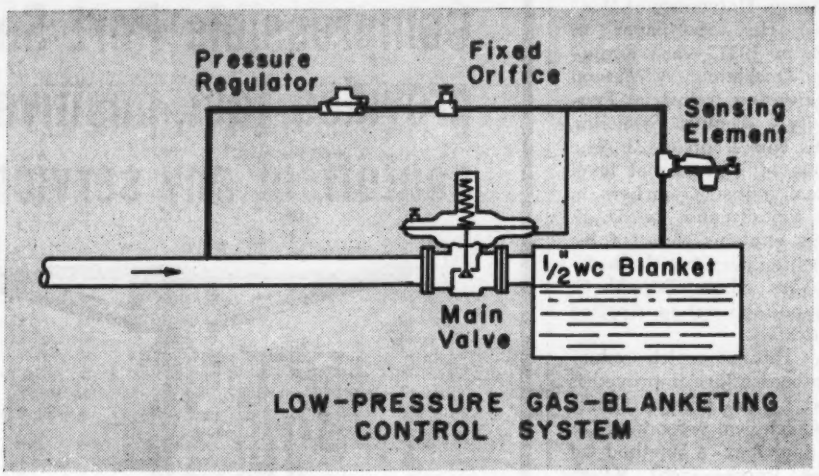


LOW-PRESSURE GAS-BLANKETING CONTROL SYSTEM

Need gas-blanket control at low pressures?

A simple system has proved successful in several CPI installations

DOWN TO PRESSURES of two-inches wc, gas-blanket pressure control on liquid-storage and process tanks is not much of a problem. But, below this point a pressure regulator alone is not enough.

A NEW SOLUTIONS FEATURE

Just what is enough has stumped many an operating man in the CPI. This fog apparently is lifting, however. A simple control system for low-pressure gas-blanket control has met with complete success in initial installations in chemical plants. It has met the following desired characteristics for such a set-up:

1) High speed of response to protect tanks in the event of sudden surges.
2) Accurate control at pressures as low as ½" wc.
3) Economical initial installation.
4) Simple reliable components that are easy to maintain.

The pilot-operated control system is schematically diagramed above. The main valve (with pitot tube plugged) is installed close-coupled to the process or storage tank. This eliminates all possible time lag of gas entry to the tank. It incorporates a 14- to 28"-wc spring set at 10 oz. (The valve should be ½ to 1" oversize for fast high-capacity action.)

The sensing element is a ¾" regulator with ½" orifice. It is set at ½" wc and is installed upside down. The weight of its parts aids it in maintaining the ½"-wc setting. This regulator also acts as the variable orifice in the system.

On a decrease of pressure in the tank of 0.1" wc, the regulator opens to relieve the pressure from the lower-diaphragm casing of the main valve. This causes the main valve to open, allowing gas to enter the tank. Since maximum droop or offset of the regulator on 0.4- to 1.0"-wc control is 10%, the control range of the gas blanket is 0.1" wc.

At ½" wc (or slightly above) the main regulator closes. This causes a buildup of gas pressure under the main-valve diaphragm, thus closing it.

(Low-pressure gas-blanket control system is development of Fisher Governor Company, Marshalltown, Iowa.)

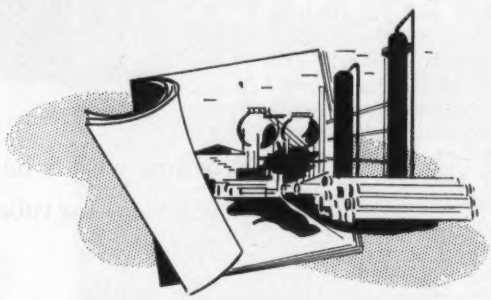
Check 5277 opposite last page.

▶ A NEW SOLUTIONS ARTICLE

A NEW SOLUTIONS FEATURE

"New Solutions" articles —

PLANT TOURS



AT YOUR DESK

In these days of the "profit squeeze" . . . and the push for every lower operating costs . . . how often have you wished for the opportunity to swing through other plants to see how THEY are attacking and solving the same problems YOU have? Trouble is, of course, that you're up to your ears in every-day, urgent tasks that keep you pretty well confined to your own plant.

Well . . . the "New Solutions" articles appearing every month in *CHEMICAL PROCESSING* magazine are designed just for busy men such as you. Each one is, in effect, a guided plant tour you can take without even leaving your desk!

Here are objective, concise reports (often two dozen per issue) that "take you by the hand" and show you how specific manufacturers have matched wits with and won out over some tough processing problems. They're geared to what's happening NOW in moves toward increased efficiency and lower costs in all segments of the operational picture.

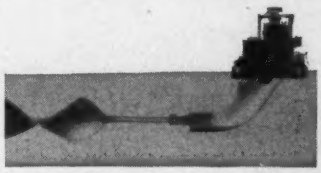
You'll find them throughout each issue of *CHEMICAL PROCESSING*. Look for their identification by the "trademarks" shown at the top of this page.

Why not thumb through this issue now? Chances are you'll find an answer to that "toughie" that's been plaguing you for weeks!

Solids flow tale told on granular materials by volumetric meter

A solids flowmeter measures total flow of granular material in vertical ducts, spouts, or pipes with diameters to 40".

A helical quarter-turn vane in pipe converts velocity of the flowing material into rotational speed. Rotary motion is carried out of the pipe at 90° to material flow by means of a flexible shaft and a set of change gears.



Solids flowmeter incorporates helical quarter-turn vane in pipe to convert velocity of flowing material into rotational speed

Air-pressure connection in flowmeter provides air flow for purging any dirt which may have tendency to work into bearings from measuring pipe.

(Solids flowmeter is product of Bailey Meter Company, 1050 Ivanhoe Rd., Cleveland 10, Ohio.)

Check 5278 opposite last page.

NEXT MONTH

The Process Instrumentation & Laboratory Apparatus Section takes the center stage of next month's CP. A number of major articles are lined up to satisfy our readers' hunger for the latest developments in this fast-moving field.

Special stories have been planned on two of the hottest topics in the field: cryogenics instrumentation and control and mass flowmeters. Instrument-maintenance training, evaluation of a computer's usefulness to your plant, and closed-circuit TV are also among the up-to-the-minute subjects spotlighted in the September Process Instrumentation & Laboratory Apparatus Feature.

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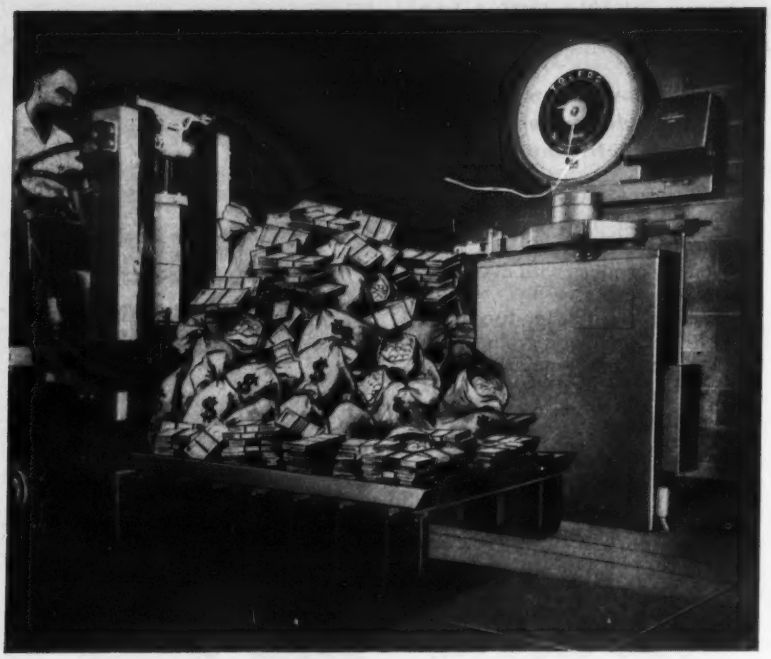

Why you should think of your scales as MONEY WEIGHING MACHINES

Cold, hard cash is the final value yardstick you must apply to every material or product that moves into, through, or out of your plant. How much does it cost? How much does it save? How much profit does it produce? In the last analysis, the answer always comes up in dollars and cents.

With dollars at stake, the *right* Toledo Scale at each weighing point is of the *utmost importance* . . . the backbone of control your needs demand. Your Toledo representative will take a personal interest in helping you get all the benefits provided by advanced Toledo methods and equipment. Write today. Toledo Scale, Division of Toledo Scale Corporation, Toledo 12, Ohio. *(Toledo Scale Company of Canada, Ltd., Windsor, Ontario.)*

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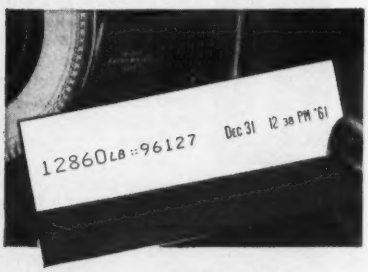

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Under $10,000 price tag carried by computer for process control

Uses: Real-time control for fractionating towers, butadiene processing, and other multivariable chemical processes.

Features: Prices of analog computer-controller vary from about $5000 to $10,000 for typical installations. Stability and over-all accuracy specifications depend upon number of variables and outputs demanded, but may be as good as ½% for both short- and long-term periods. All computing components are solid-state.

Description: Either feed-ahead or feedback computation techniques may be employed with analog computer-controller. Typical installations provide one to three outputs, five to ten inputs. Modular construction permits custom units for each application. Unit may be used for operator guidance or equation solution for engineering design and analysis.

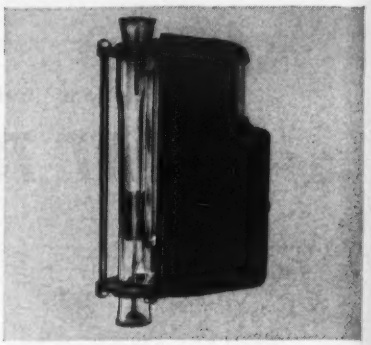
Usual installation uitilizes operational amplifiers, scaling potentiometers and logarithmic networks housed in 48" high x 30" wide x 10" deep sealed pressed-steel cabinet . . . or mutliple cabinets if required. Construction meets Class 1, Section 2 requirements with purging.

(CM-3 analog computer-controller is product of SIE Division, Dresser Electronics, Box 22187, Houston 42, Tex.)

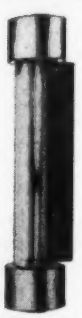
Check 5281 opposite last page.

"Of course, this is probably an over-simplification . . ."

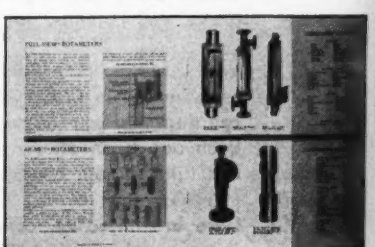
METERING CORROSIVE FLUIDS? Brooks can give you an all-glass *transmitting* rotameter like this . . .



or one with a halofluorocarbon metering tube like this . . .



In fact, we can make a meter to just about any material specifications you might want. This eight-page bulletin . . .



describes more than a dozen of the many materials available and gives meter construction details. Ask for Bulletin 150, and it's yours.

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Check 5282 opposite last page.

THAT'S INTERESTING

Changes $1 or $5 bills

An automatic bill and currency changer, manufactured by National Rejectors, Inc. and engineered by Designers for Industry, Inc., uses an electronic sensing device to scan and detect bills.

When a user places a bill in a receptacle, and presses a button, sensing device automatically identifies and makes the change. Spurious bills are returned to operator.

Million mi of glass

Threads, making up glass-fiber casing of experimental Polaris motor, would stretch 1.5 million mi if placed end to end.

Motor, 14′ long and 4½′ in diam, was 3 times larger than any glass case used successfully before. Case was manufactured by Aerojet-Generals Structural Materials Div.

For more information on product at right, specify 5283 see information request blank opposite last page.

A NEW ADDITION TO THE SONAC *LINE*

POSITIVE ULTRASONIC LEVEL CONTROL

The components of Sonac (sensor actual Size)

Now, two new ultrasonic sensors, especially for level control have been added to the Delavan line of SONAC sensing and switching devices.

The single sensor system is recommended for liquid level control and the double sensor system for dry level control.

Control is maintained by installing the SONAC sensor through the wall of the vat, bin or hopper. When the oscillation on the face of the sensor is dampened or impeded by the material being sensed, the signal to the control unit changes, activating a relay.

FIG. 1—LIQUID LEVEL (One Sensor)

FIG. 2—DRY LEVEL (Two Sensors)

For level control, SONAC is accurate to .005″ and has a response time of 25 milliseconds. Performance of the sensor does not deteriorate with age.

The level control uses to which SONAC can be applied are virtually unlimited. It is not affected by the viscosity*, specific gravity, conductivity, or capacitance of the material being sensed. Temperature or pressure changes of the material do not alter its performance. False signals are eliminated because SONAC may be adjusted so as not to sense steam, foam, or vapors.

*Viscosity may affect response time.

Canadian Representative:

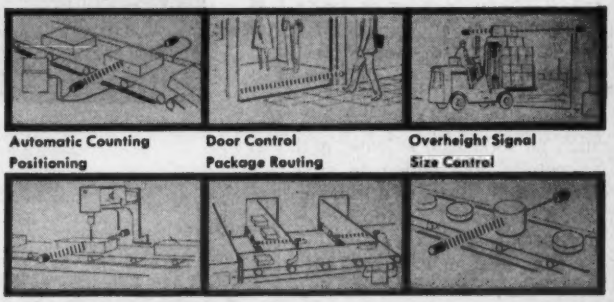
KNOWLES & FOSTER (North America) Ltd.

706 Terminal Bldg., Toronto 1, Ontario, Canada

SONAC is extremely rugged. Sensors are type 304 stainless steel. The electronic components in the sensors are hermetically sealed and will withstand pressures to 2000 psi and temperatures from −425° F. to +450° F. They are immune to shock, vibration or mechanical damage.

The control is a compact unit 5″ x 5″ x 5″ and features transistor circuitry. Power consumption is one watt and the unit will operate in temperature ranges from 40° F. to 135° F.

Here's how SONAC can be used for sensing and switching applications other than level control.



Automatic Counting Positioning | Door Control Package Routing | Overheight Signal Size Control

There are dozens of applications for SONAC *single and double sensor units. Let it go to work for you now, write:*

DELAVAN Manufacturing Company

WEST DES MOINES • IOWA

Laboratory Report

▶ A NEW SOLUTIONS ARTICLE

Detergent-process work receives big boost from speedy blender

Versatile laboratory blender shows industrial promise

Chemists at Ultra Chemical Company's research laboratory in Paterson, N.J., are developing improved industrial detergents using a new dry-neutralization process. In this work, they are employing a specially designed plastic-shell liquids-solids lab blender.

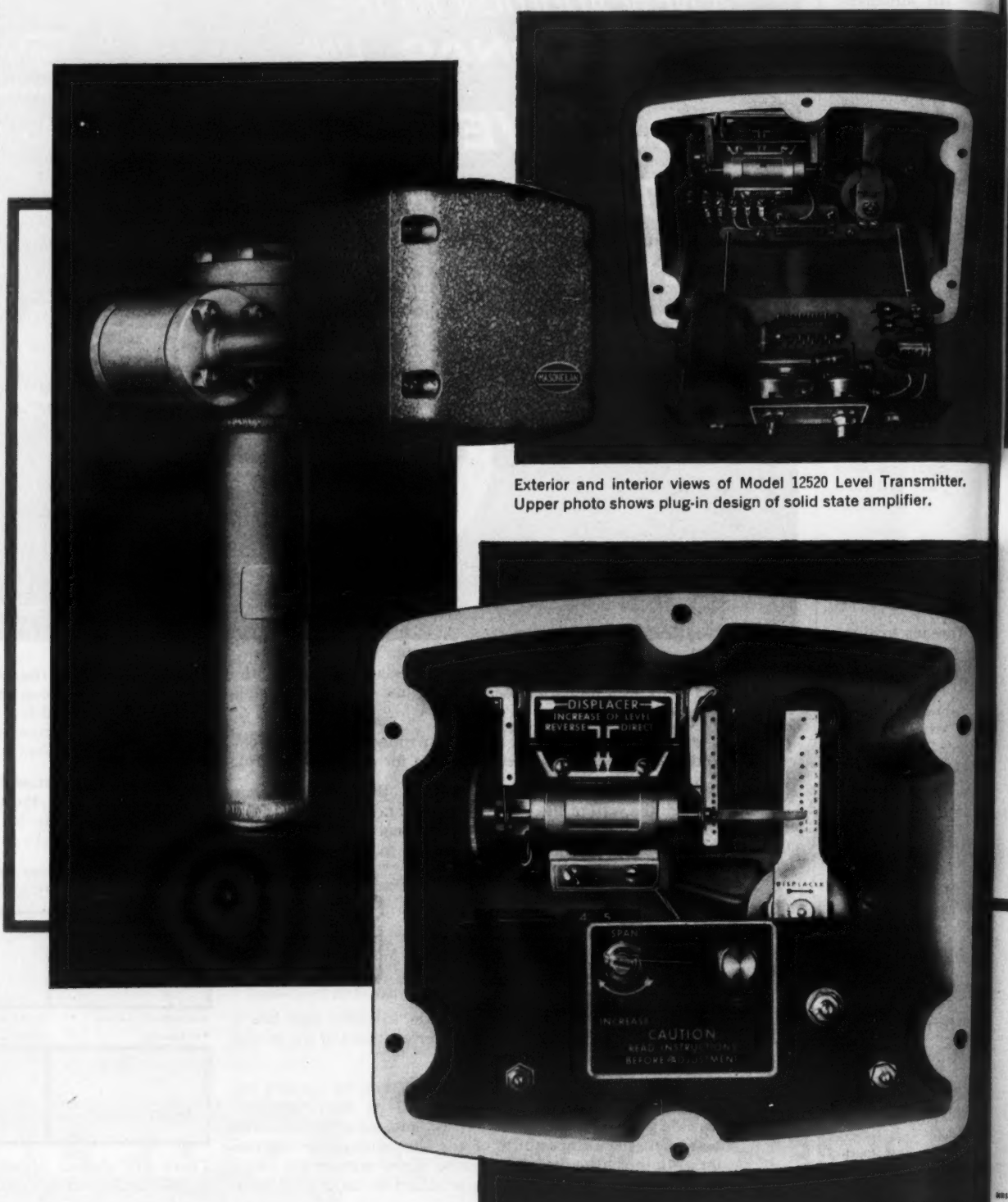
The blender has proved faster than previous equipment or methods utilized and provides a convenient blending

Ultra Chemical Company's research laboratory is utilizing a liquids-solids lab blender to develop improved industrial detergents using a new dry-neutralization process

process which produces a highly uniform product. According to Ultra Chemical, the V-shape blender is quite versatile and shows promise for use in future industrial-detergent-blending applications.

Various "builder" agents, such as soda ash, silicate, and phosphate, are added to sulfonic acid—the active cleaner in all detergent compounds—during the experiments.

Soda ash neutralizes sulfonic acid, thus removing any handling restrictions for the final product. Silicate maintains alkalinity of the product and affords protection for any aluminum parts in the washing mechanism while



Exterior and interior views of Model 12520 Level Transmitter. Upper photo shows plug-in design of solid state amplifier.

Mason-Neilan Presents.....

A New High-Quality Electronic Liquid Level Transmitter

Making the proven advantages of displacement level measurement available for centralized electronic control systems

Mason-Neilan has utilized the best features of mechanical and electronic design to provide a new device for transmitting dc signals proportional to level variations.

This transmitter combines the time-tested, field-proven variable displacement measuring element made famous by the 12000 Series pneumatic level controllers, with an LVDT displacement transducer and a solid state amplifier. A choice of output signals permits use with any presently available electronic receiver — indicator, recorder or controller.

Consider these important features:

Accuracy . . . within 1%. High feedback serves to maintain accuracy and stability under changing ambient conditions. Torque tube assembly design insures true center of rotation — eliminates objectionable friction.

Reliability . . . solid state circuit with components of the highest quality.

Versatility . . . wide choice of output signals and level ranges. Left or right hand case mounting — reversible in the field. Selection of mounting types to meet all vessel requirements.

Ruggedness . . . sturdy aluminum explosion-proof instrument case provides maximum durability and protection to all internal parts.

Simplicity . . . adjustments are readily accessible and easily made. Plug-in amplifier assembly for convenient maintenance.

Complete data are yours for the asking. If you are now using, or contemplate using, electronic controls, we invite you to get in touch with a Mason-Neilan representative, or write to

MASONEILAN

Products that Work for Your Profit

MASON-NEILAN

Division of Worthington Corporation

25 NAHATAN STREET, NORWOOD, MASSACHUSETTS, U. S. A.

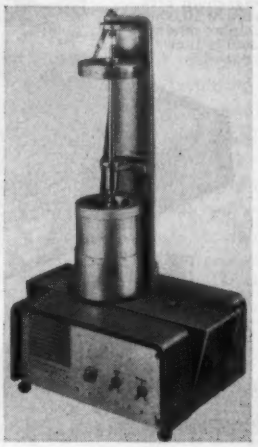
Check 5284 opposite last page.

phosphate boosts the detergent action of sulfonic acid.

Tests are sometimes run with color additives in the "builder" agents to visually check dispersion action of the blender. In this manner, chemists can quickly evaluate efficiency of the liquids-solids unit.

(Liquids-solids lab blender is product of The Patterson-Kelley Company, Inc., E. Stroudsburg, Pa.)

Check 5285 opposite last page.



Measure one-million cp

. . . with viscosimeter incorporating thermostated bath that can be operated up to 300°F. Instrument measures viscosities of either two liquids or non-Newtonian liquids by rotation method, in "degrees MacMichael" (300 to a circle). Measurements can be converted directly into centipoises once instrument has been calibrated against liquids of known viscosity.

Results are reproducible to ±1° M, due to adjustable thermostat response to changes of ± 1°F, and to motor that rotates bath and sample cup being easily adjusted for speeds of 10 to 38 rpm. Cast aluminum viscosimeter operates on 115v 50/60-cy AC.

(Further information on MacMichael viscosimeter may be obtained from Fisher Scientific Company, 303 Fisher Bldg., Pittsburgh 19, Pa.)

Check 5286 opposite last page.

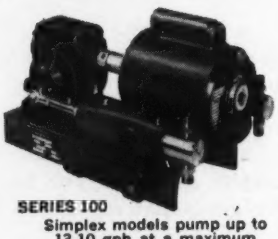
ACCURATE CHEMICAL FEEDING

from .65 gph to 1624 gph

SERIES 200
Self-contained lubricating system—no downtime for lubrication. E.Z. Clean Cartridge liquid end simplifies maintenance. Simplex models pump up to 812 gph at a maximum pressure of 10,000 psi. Duplex models double that capacity.

American controlled capacity proportioning pumps have repetitive metering accuracy of plus or minus 1%, when operating between 10% and 100% of capacity. Feed precisely metered fluids or slurries in virtually all ratios, with flow, temperature, pressure, conductivity, pH and other controlled process variables.

- interchangeable liquid ends
- spherical self-aligning bearings on crank and crosshead handle greater radial and axial thrust loads
- crossheads of hardened and ground steel ride on cast iron
- nylon dust covers protect bearing surfaces
- NEMA frame motors
- heavy duty reducers



SERIES 100
Simplex models pump up to 13.10 gph at a maximum pressure of 1000 psi. Duplex models double that capacity.

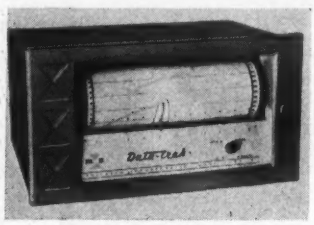
AMERICAN®
METER COMPANY
INCORPORATED (ESTABLISHED 1836)
pump division
13500 PHILMONT AVE., PHILADELPHIA 16, PENNA.

Check 5287 opposite last page.

Manual set-point control converted to automatic program control

Function generator converts manual set-point control to automatic program control. Just add a pencil-drawn program curve and connect three wires from instrument's output potentiometer to present circuits. As instrument stylus follows program track it actuates a control potentiometer.

As many as four, three-gang potentiometers may be driven by same follower mechanism to provide up to 12 separate synchronized control signals. Standard strip-chart recorder paper may be used for program chart.



Instrument can provide up to 12 separate synchronized control signals

Entire mechanism is enclosed in 19-inch dust-tight case which fits a standard electronic rack. Chart, follower and position indicators are continuously visible through glass cabinet door.

(Data-Trak function generator is a product of Research, Inc., PO Box 6164, Minneapolis 24, Minn.)

Check 5288 opposite last page.

Adapter calls the shot on variable magnitudes

An adapter has been developed which continuously computes fluctuation magnitude of any process variable. It reads fluctuating 0 to 0.5v AC input from transmitter, computes fluctuation magnitude, and transmits proportional signal to controller.

Adapter is useful in any dynamic-process situation where controlled level of one variable is dependent upon fluctuation magnitude of another. Working with appropriate controls, unit will maintain constant fluctuation magnitude regardless of quantitative variation in level of monitored variable.

(Fluctuation Adapter A41A/1 was originally produced for use in TCC process of Socony-Mobil, designers of the equipment. It is now being manufactured for general industrial use under licensed agreement with Secony by Swartwout Division, Crane Co., Hooksett Industrial Park, Manchester, New Hampshire).

Check 5289 opposite last page.

Count rates of 30,000/min don't ruffle chart integrator

Uses: Intergrator permits computation of area under strip-chart curve.

Features: Chart integrators are available with count-rate ranges of 1 to 30,000 counts/min. Ranges can be selected to suit operating requirements by changing integrator time motor.

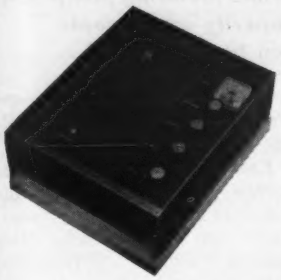
Description: Chart integrator can handle any variable such as flow, sun radiation, electric-power or x-ray analysis at same time it is being recorded. It is particularly applicable to gas chromatography where peak areas are needed.

No zero-drift or change in range will take place over wide temperature range. Accuracy is to within + 0.1% full scale of area under curve. Sharp peaks down to less than ½ sec duration can be integrated without lag error.

(Chart integrator is product of Disc Instruments, Inc., 3014-B So. Halladay St., Santa Ana, Calif.)

Check 5290 opposite last page.

For more information on developments reported in this section, check corresponding numbers on Reader Service Slip opposite last page of this issue.



A $250 chromatograph

. . . incorporates dual detection, including catalytic combustion and thermal conductivity. Unit has 1 to 125 four-position selectivity and detects five ppm hydrogen in any gas.

Chromatograph can be operated by non-technical personnel after less than one hour of instruction. It provides quality control of any raw material of finished product with boiling points to 105°C and of many with boiling points to 120°C. Unit measures 11″ wide x 13″ deep x 5″ high, and sets up in 30 minutes or less.

(Chronofrac VP-1 chromatograph is product of Precision Scientific Co., 3737 W. Cortland, Chicago, Ill.)

Check 5291 opposite last page.

Recorder deftly handles 16 points at once

A multi-range 16-point recorder has four groups of four points with any group on any on the following ranges: 1, 2, 5, 10, 20 or 50mv DC.

Range change is automatic from one group to the next. Each group also has a separate zero-suppression circuit with range of ± 50mv in steps of 1mv.

Chart speeds of two, four, six or eight inches/min are selected by change of gears. Throwing a switch automatically reduces any speed by factor of 10.

(Multi-range 16-point recorder is product of The Indikon Company, 76 Coolidge Hill Road, Watertown 72, Massachusetts.)

Check 5292 opposite last page.

neptune

An advertisement written to help you

Measurement/Control News

prepared by Neptune Meter Company

How St. Regis Gets Closer Control Over Clay & Starch Mixes

DEFERIET, N.Y.—In preparing both clay and starch mixes, the St. Regis fine paper mill here controls solution strength with automatic meters. In clay, meters are used at *three* stages: Adding water to dry clay to make 55% slurry; cutting slurry to 15%; and proportioning slurry and water at the beater to dilute to 2%.

In starch, meters measure water into cooker for 20% mix, then measure both hot starch and water for accurate dilution to 8%. Meters are Neptune Auto-Stop, 1 to 2 inches.

What works on starch and clay can also work for you. Write today.

Meter with a memory... Never forgets your formula

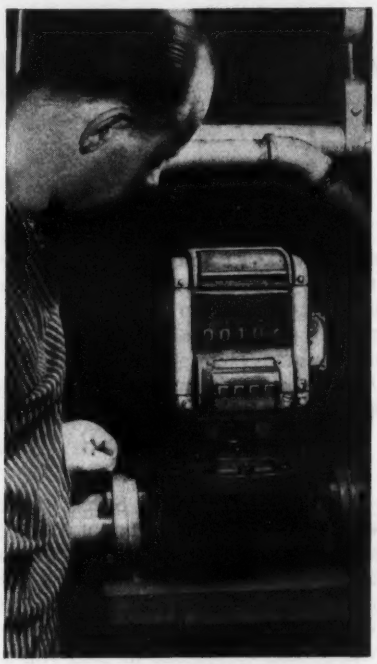
For liquid batching where formula repeats, this automatic meter has precise mechanical memory. Set quantity just once, open valve, and meter takes over. Shuts off at correct quantity batch after batch. Can even print tickets. Easy to reset for new formula. Ask for facts on Repeating Auto-Stop.

HOW TO STOP DRIP OF VISCOUS LIQUIDS. When metering viscous liquids, don't try to drain the line between meter and vat after each delivery. It'll drip forever, and you usually don't want air contact anyway. Instead, put an inexpensive spring-loaded Anti-Drip valve on the end of the pipe. Ask Neptune.

West Chemical Improves Accuracy With Stainless Steel Batching Meters

Operator merely pushes buttons; Auto-Switch shuts off pump at exact quantity

LONG ISLAND CITY—For safety, speed and accuracy, West Chemical Products, Inc., reports excellent results after replacing gauge-stick measurement with stainless steel liquid meters in formulating CN-Plus, Westpine, Tamed Iodine and other West sanitation products.



"Big savings are time and materials," says Rudolph Londner, plant superintendent. It took time to stop the agitators, wait for liquids to stop swirling, open the lids, and read the gauge sticks. And when batching errors showed up in the quality control lab, *more* time was wasted making adjustments and retesting.

Now accuracy is controlled by push-button. A row of buttons on each meter sets the quantity. A switch starts the pump. The meter keeps count and stops the pump *automatically* at the anticipated quantity.

Plouronics-Iodine Complexes

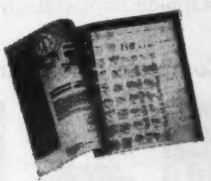
For ingredients such as plouronics-iodine complexes, West uses Neptune stainless steel Auto-Switch meters, which have only two moving elements in contact with liquid. For non-corrosive liquids, bronze Auto-Switch meters are used.

By assuring closer control, meters help comply with labeling regulations, and assist in obtaining government contracts. West also uses Neptune meters in ion-exchange and chlorination processes, and in the manufacture of waxes and soaps.

How can you benefit from West Chemical's experience? Neptune field engineers will be happy to offer helpful suggestions. Phone or write today.

HELPFUL METERING DATA AVAILABLE

28-pg. technical bulletin lists liquids, helps pick proper sizes and features of meters 2 to 2000 gpm.



NEPTUNE METER COMPANY · Liquid Meter Division
47-25 34th St., Long Island City 1, N.Y.

Please send me helpful Meter Bulletin 566QP

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

Check 5293 opposite last page.

NEW M-S-A® PROCESS REFRACTOMETER

16½" wide x 11¾" high x 12" deep

measures components of organic and inorganic streams in these typical applications:

Acetone in water
Alcohol in water
Ammonium sulfate in water
Benzene in cyclohexane
Benzene in ethanol
Boron chemical processing
Brine concentration
n-Butane in isobutane
Butadiene purity
Citrus juice blending
Cyclohexane in benzene
Cyclohexane separation from normal-hexane
Distillation control
Ethanol in benzene
Ethanol in water
Ethylene glycol in water
Food products
Gasoline additives
Gasoline fractionation
Glycerol in water
Hydrogenation of food oils
Isopropyl alcohol and methyl ethyl ketone in secondary butyl alcohol
Isopropyl alcohol in water
Methanol in water
Monitoring chromatographic columns
Nitric acid in water
Polymerization control
Propylene glycol in water
Separation of aromatics
Sodium chloride in water
Stream blending
Styrene in ethylbenzene
Sugar concentrates
Sugar in water
Sulfuric acid in water
Vinegar production
Water in acetic acid
Water in ethanol
Water in methanol

WHERE TO USE IT

You can use the new M-S-A® Process Refractometer for industrial applications in production or research. This unit controls either stream or batch processes. Measures and controls product quality. Solves a variety of problems requiring rapid, accurate determinations. Conversion to *new* problems is quick and easy. We've listed some typical applications at the right.

PRINCIPLE OF OPERATION

The M-S-A Process Refractometer depends on the differential refraction of light passing through two materials which may have different refractive indexes. It detects and measures the change in light bending due to a variation in refractive index of a "sample" relative to a constant standard. This variation is detected by a Cadmium Sulphide Photocell Circuit.

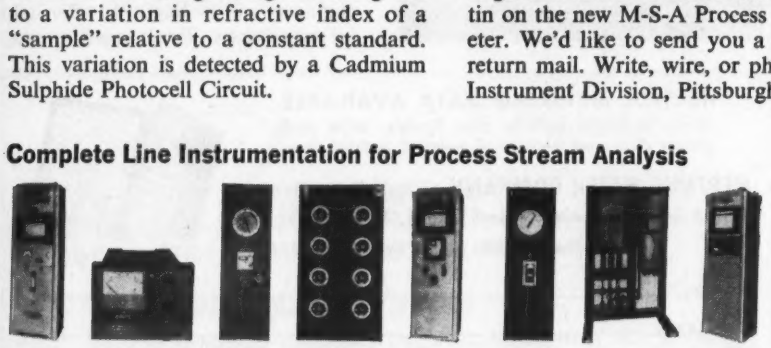
SPECIFICS

This is a high sensitivity instrument: 0 to .005 RI units full scale. Accuracy is ±1% full scale or ±.000005 RI, whichever is larger. Zero drift is 1% full scale or less per day. Response is 90% in 30 to 60 seconds. Sample flow required: 5 to 20 cc/minute. Available in explosion-proof or non-explosion-proof construction. Power needs: 50/60 cps—100 watts—115 volts.

MSA ASSISTANCE

MSA Instrument Specialists, implementing more than 30 years of MSA experience in gas analysis, can help shed some light on your sampling problems. First, perhaps you might like to look over our technical bulletin on the new M-S-A Process Refractometer. We'd like to send you a copy in the return mail. Write, wire, or phone MSA's Instrument Division, Pittsburgh 8, Pa.

Complete Line Instrumentation for Process Stream Analysis



M-S-A® LIRA® Infrared Analyzer Model 200 | M-S-A® LIRA® Infrared Analyzer Model 300 | M-S-A® Inert Gas Analyzer | M-S-A® Combustible Gas Analyzer | M-S-A® Thermatron Analyzer | M-S-A® Oxygen Indicator | M-S-A® Water Vapor Recorder | M-S-A® BillionAire® Analyzer

*Trademark

INSTRUMENT DIVISION
Mine Safety Appliances Company
Pittsburgh 8, Pennsylvania

Check 5294 opposite last page.

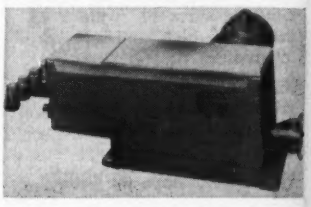
While metering pump runs, capacity adjustments can be made

Uses: In low-flow controlled-volume chemical-feeding systems.

Features: Capacity adjustments can be made while pump is running—either manually or automatically from control signal. Adjustment may be made from forward end of stroke.

Description: Essentially, drive utilizes worm shaft and gear, crank with adjustable axis, and connecting rod with ball-and-socket-type ends to convert the rotary motion of the drive motor into reciprocating motion of pump plunger.

Each complete revolution of the crank concludes one full pump stroke (suction and discharge). When pump is set



Drive of metering pump converts high-speed rotary motion of drive motor into reciprocating motion of the plunger

at full-stroke position, crank revolves in plane few degrees off the vertical axis. At top of the rotation, plunger is all the way forward (discharge).

At the bottom of this rotation, the plunger is drawn back to the percent of full stroke governed by the setting (suction). Regardless of how the stroke is set, however, the plunger always returns essentially to the same forward position at the top of each crank revolution.

This action permits adjustment from the forward end of the stroke. Pump capacities are in 0.89 gph (for pressures to 4470 psi) to 88.0 gph (for pressures to 170 psi).

(Milroyal metering pump is product of Milton Roy Company, 1300 E. Mermaid Lane, Philadelphia 18, Pa.)

Check 5295 opposite last page.

NEW LITERATURE
Process Instrumentation and Laboratory Apparatus

Laboratory instruments, apparatus and chemicals are compiled in nearly 1500 pages of comprehensive listings. All principle items are illustrated on same page as catalog listing in Cat 109—E. H. Sargent & Co.

Check 5296 opposite last page.

Plastic laboratory ware of various types is drawn and specified in 22-page Cat PA-81—Palo Laboratory Supplies, Inc.

Check 5297 opposite last page.

Plastic laboratory ware is described, illustrated and priced in 44-page 1961 Cat—Bel-Art Products.

Check 5298 opposite last page.

Laboratory furnaces, ovens and heating apparatus are considered in 24-page Cat 92—Burrell Corporation.

Check 5299 opposite last page.

Small organic glass apparatus for the laboratory is tabulated in 32-page catalog containing drawings and descriptions of various items in line. Cat BW-2—Kontes Glass Company.

Check 5300 opposite last page.

Digital telemeter system is taken up in four-page bulletin including descriptive schematics, system specifications and available accessories. Bul GEZ-3312—General Electric Company.

Check 5301 opposite last page.

Relative-humidity measurement and control is considered in 68-page catalog picturing and specifying variety of equipment. Complete explanations of operating principles of units covered are included in Cat 661—The American Instrument Company, Incorporated.

Check 5302 opposite last page.

Continuous on stream colorimetric analyzer is topic of 14-page brochure describing typical applications such as silica determination on demineralizer effluents in 0- to 300-ppb range. Chemonitor Brochure—Hagan Chemicals & Controls, Inc.

Check 5303 opposite last page.

Nuclear-gage systems for controlling specific gravity or density and liquid or interface levels are diagramed and explained in Bul 105-C—The Ohmart Corporation.

Check 5304 opposite last page.

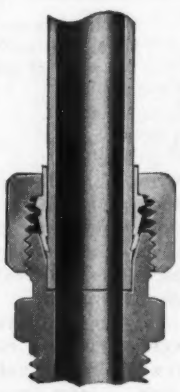
THESE PARKER TUBE FITTINGS MEET YOUR EXACT NEEDS

Processing demands specific fittings—not a "general" type

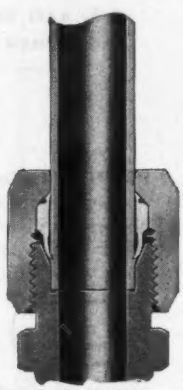
Parker covers *every* specific processing application with a fitting built for the job. There's inexpensive "Intru-lok" for instrument air . . . husky "Ferulok" for high pressures in steel and stainless steel. Both are positive, bite-type fittings. For complete corrosion resistance, new "Ridg-lok" is 100% of type 316 stainless.

Where flared tubing is used, the Parker 37° "Triple-lok" is the acknowledged leader, available in any practical metal.

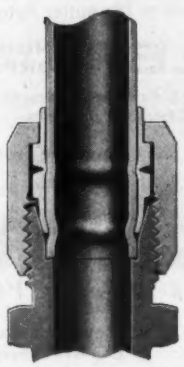
For extreme temperature conditions at any pressure, "Weld-lok" combines ease of assembly and streamlined flow. "Braze-lok" withstands somewhat less heat, but is even easier to assemble and can be disassembled when necessary.



FOR INSTRUMENT AIR, use "Intru-lok®" brass and aluminum tube fittings with the captive ferrule you can't lose. For copper, aluminum, Nylon and "Parker-POL" polyethylene tubing. Simple, compact, easy to install, inexpensive. Ask for Catalog No. 4324.

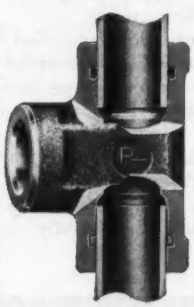


HIGH PRESSURES require "Ferulok®" heavy-duty flareless fittings with the visible bite that lets you make sure you have safe make-up. Usable with heavy-wall tubing. Excellent vibration resistance. Stocked in steel, stainless steel; available in Monel. Ask for Catalog No. 4320.

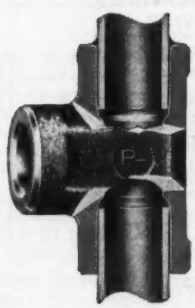


COMPLETELY CORROSION RESISTANT "Ridglok" fittings are all stainless steel (type 316). Unique ferrule design provides safe, dependable non-flare grip. Ferrule "foolproof"—identical ends make it impossible to put in backwards. Ask for Catalog No. 4322A.

BRAZED JOINTS can be used where there isn't room to swing a wrench. They give you a permanent joint, yet one that can be taken apart and re-used. You just apply heat, either to make or break the joint. Parker "Braze-lok®" is completely reliable for high pressures at temperatures up to 500° F. Steel, stainless steel, Monel and cupronickel. Catalog 4375.



WELD WITH Parker "Weld-lok®" whenever a permanent joint will best serve your purpose . . . when the process is hazardous, when temperatures or pressures are extreme, when vibration is a problem. "Weld-lok's" socket design makes assembly easy. Steel and stainless steel in stock; aluminum available. Catalog 4370.



Complete specifications and engineering help are available from your nearby Parker distributor. Find him through the Yellow Pages, or write us direct.

Parker FITTINGS AND HOSE DIVISION
17325 Euclid Avenue • Cleveland 12, Ohio
PNEUMATIC AND HYDRAULIC SYSTEM COMPONENTS
EUROPEAN DIVISION • PARKER-HANNIFIN N.V. • SCHIPHOL • THE NETHERLANDS

8200-PHe

Check 5305 opposite last page.

LARGE CHEMICAL PLANT
REDUCES LABOR COSTS
$80,000
WITH 4 OF THESE MACHINES!

MILLER AUTOMATIC BAG PALLETIZER

This completely automatic, operatorless unit is specifically engineered to slash production costs in two-and three-shift plants. One large chemical plant replaced 16 men and saved $80,000 annually by installing 4 of these palletizers!

While you're thinking about it, write for bulletin describing operation of the Miller Automatic Palletizer!

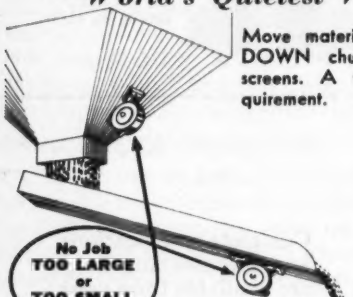
MILLER ENGINEERING CORPORATION

119-B East Barbee Avenue
Louisville, Kentucky

Check 5306 opposite last page.

VIBROLATOR® VIBRATION INDUCERS

"World's Quietest Vibrators"



Move materials OUT of hoppers, DOWN chutes and THROUGH screens. A vibrator for every requirement.

FEATURES:

- LONG LIFE
- RUGGED
- POWERFUL
- UNIQUE DESIGN
- PATENTED THROUGHOUT
- UNCONDITIONAL GUARANTEE

FREE 30-DAY TRIAL ON ALL SIZES.
Stocking distributors coast-to-coast listed under VIBRATORS in the Yellow Pages.

42-page CATALOG ON REQUEST

FIND US FAST IN THE YELLOW PAGES

Manufactured by:
MARTIN ENGINEERING COMPANY
Specializing in Applied Vibration
155 Kemp St., Neponset, Illinois

VIBROLATOR

● VIBROLATOR is Martin Engineering's registered trade mark for vibration inducers and vibrator accessories.

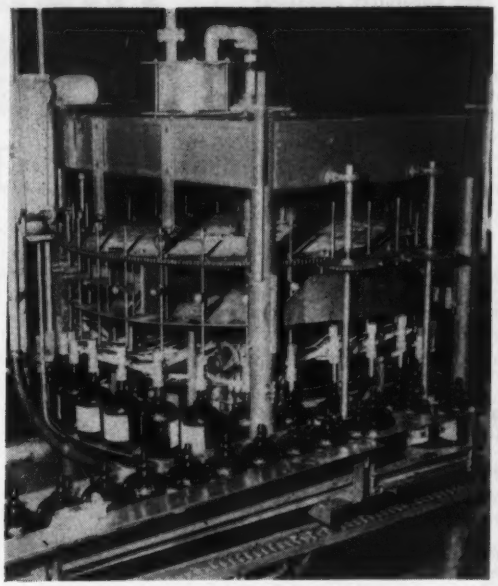
Check 5307 opposite last page.

CP MATERIAL HANDLING and PACKAGING

2 FILLERS DO WORK OF 5

Readily interchangeable contact parts enable unit to handle diverse products

By **KARL ROBE**, Editor West
with **NATHAN SMOOKE**, President
Lady's Choice Co.



Simple chain-sprocket drive and motor are above filling area, easily accessible for maintenance but out of splash area during washdown

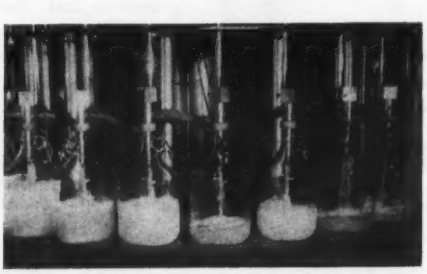
PROBLEM: Due to variety of products — laundry bleach, liquid starch, other household cleaners, vinegar and sirups — filled in diverse sizes of containers, five lines were required in the San Francisco plant of Lady's Choice Co.

A NEW SOLUTIONS FEATURE

Separate fillers were needed for different classes of products. The alternative was time-consuming, non-productive cleaning of filler valves, pumps, tubing, vacuum systems and overflow tanks.

Existing lines were slow, required considerable maintenance, and occupied extensive floor space. Several large complex layouts were considered for modernizing the system.

Solution: At minimum capital outlay, two 30-pocket high-speed automatic fillers were installed, each designed so that contact parts could be rapidly interchanged.



Plastic tubing and filling parts are impervious to chlorines, bleaches, cleaning agents and vinegar

Filler can run gamut from half-pint bottles to two-gal cans, with only a five-minute pause being required for the adjustment to a different height of the simple external roller cams on each filler valve.

Fully automatic, the machine is equipped with a no-bottle, no-fill device on each filling valve. The machine also has at its inlet conveyor a simplified pressure bar which stops the unit whenever the bottle supply is inadequate for efficient filling.

Although filling can be done under vacuum or pressure, vacuum is used at Lady's Choice. A float valve operates the product pump, keeping a uniform head of product on the inlet system for uniform filling. A glass separator controls the product surge and eliminates spillage.

Drive and motor parts are positioned above the filling heads, facilitating maintenance, while permitting complete, quick wash-down on one hand, and eliminating need for expensive housing or seals on the other.

All parts are "in the open" — easily accessible for painting, repair or maintenance.

The entire filling assembly revolves around a central shaft like a merry-go-round. The top is a circular plate notched on the periphery to receive commercial sprocket chain.

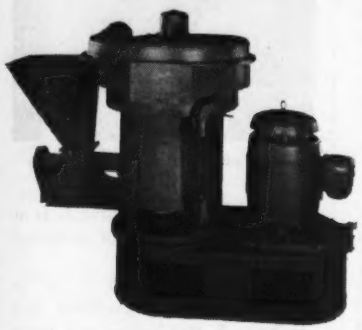
Through the sprocket, a motor drives the entire filling assembly. With this arrangement "backlash" and other signs of gear wear are eliminated. Chain parts

NEW!

Bauer

HURRICANE

PULVERIZER-CLASSIFIER



- **Pulverizes dry material to less than one micron**
- **Classifies precisely**
- **Provides ultimate uniformity**
- **Improves production control**

If you need the most precise method of reducing dry material to super fine size (even down to less than one micron!), this new Bauer air attrition mill can help you. The Hurricane Pulverizer-Classifier also accurately classifies such material as it pulverizes it.

In one typical application, involving hydroxy ethyl cellulose, yields up to 1500 lbs./hr. were reported with exact capacity depending on degree of polymerization desired. Sodium carboxy methyl cellulose also has been successfully reduced and classified in quantity.

If you are processing cellulosic derivatives or similar materials, send for information on the Bauer Hurricane Pulverizer-Classifier.

THE BAUER BROS. CO.

SPRINGFIELD, OHIO

Check 5308 opposite last page.

and sprockets are easily replaced so that the filler should last indefinitely with simple plant maintenance.

Results: Five filling lines have been replaced by two with proportionate savings in floor space and maintenance.

Clean-up time between products — a factor even with five lines — is minimized. Change parts for one product can be removed in minutes and cleaned while a new product is being filled. The latter is accomplished through the use of other change parts.

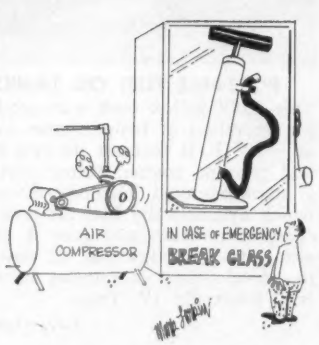
Since payout of investment on the two high-speed lines is faster than under alternate layouts considered, savings justified the use of more automatic high-speed labelers and cappers to provide reserve for future needs.

The machine fills 76 gal bottles/min and 180 quarts/min. Variable speed motor offers speeds up to 300 bpm. This capacity can be doubled for quarts and smaller sizes by adding 30 additional filler heads for which holes have already been drilled.

Operation of the two fillers was so satisfactory that a similar filler has been installed at Chlorine Solutions Co., Los Angeles, a branch company specializing in hypochlorite products.

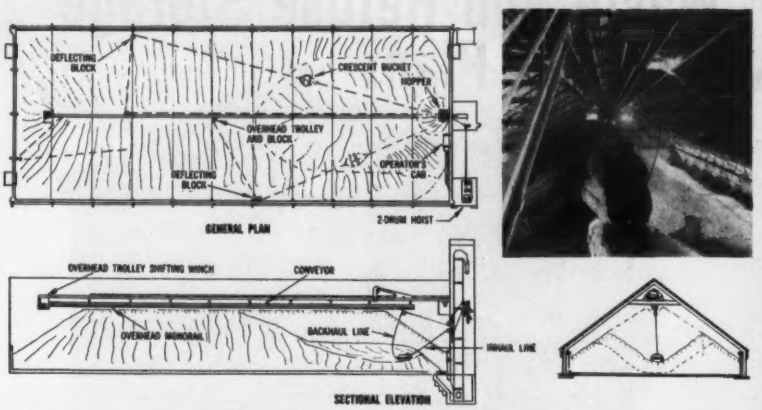
(Laub 30/60 vacuum/pressure filler is product of Laub Engineering Co., 244 N. San Marino St., San Gabriel, Calif.)

Check 5309 opposite last page.

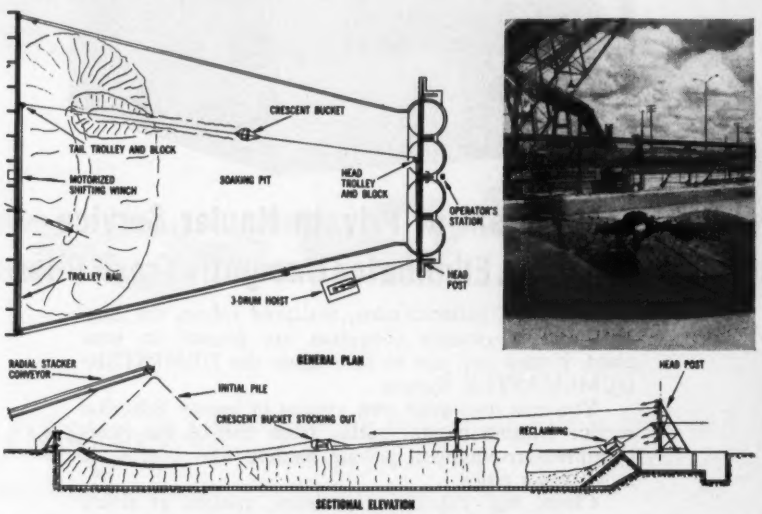


Mark Larkin, Electra Mfg. Co.

Sauerman Machines And Methods For Storage And Reclamation



Drawing and photograph illustrate DragScraper Machine using an elevated monorail trolley system along the center line of the storage building for straight-line recovery of bulk material. Overhead trolley and block are controlled by a shifting winch. Recovery is to a hopper located at center of one end wall. Deflecting blocks placed on the side walls permit the bucket to reclaim material from side areas.



Installation drawing shows details of DragScraper Machine handling shale in a soaking pit. Monorail trolleys at each end provide lateral shifting for the Crescent. The third drum on the hoist is used to shift the head end trolley and a motorized winch shifts the tail trolley assembly. The Sauerman stocks out from initial piles, reclaims shale to the wash mills at head end as required. Photo shows Crescent bucket on pile. Shifting winch, trolley rail and conveyor system are in background.

Sauerman Machines stockpile and reclaim bulk materials from buildings, bins and ground storage piles. The Crescent scraper bucket can deliver directly to one or more hoppers at ground level, to conveyors and processing machines or up a ramp to an elevated hopper.

Users of DragScraper Storage Systems find this equipment handles material at less cost per ton than other methods of stockpiling or reclaiming. DragScrapers are economical to operate in limited indoor storage facilities or ground storage areas of several acres or more. Materials handled vary in weight up to 200 lb. per cu. ft. Sauerman Machines are built in sizes from ⅓ to 15 yd. to match your tonnage requirements.

Call or write for recommendations on your material handling job. Catalog E gives specifications and general information.

SAUERMAN BROS., INC. 606 SO. 28th AVE. BELLWOOD, ILL.

Linden 4-4892 • Cable CABEX—Bellwood, Illinois

Crescent Scrapers • [illegible]

Check 5310 opposite last page.

OUT-OF-SIGHT

Waste and Refuse Storage for Your Plant

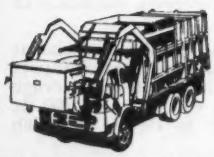
Plant-Owned System or Private Hauler Service Cuts Your Costs... Eliminates Unsightly Trash Piles

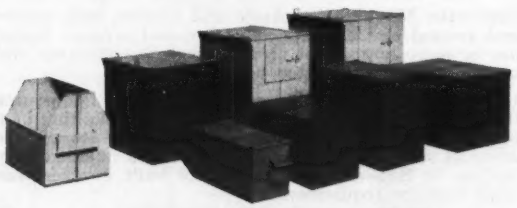
If trash piles, battered cans, scattered refuse, fire hazards and hit-or-miss collection are present in your plant, it may pay you to investigate the DEMPSTER-DUMPMASTER System.

You can own your own system or secure this vital service without capital outlay from one of the many Dumpmaster-equipped private haulers who operate in most major cities.

Clean, big-capacity containers, spotted at refuse accumulation points throughout your plant, provide enclosed, out-of-sight storage for waste and refuse, increasing plant cleanliness and improving employe morale.

Write today for a free brochure that describes this system and the name of your nearest private hauler.





ONE OF THE DEMPSTER DUMPSTER® SYSTEMS

FREE BROCHURE

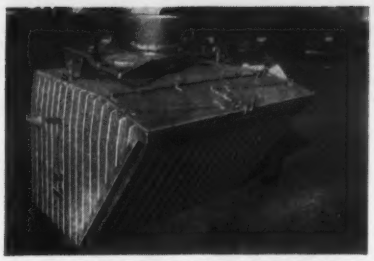
Write for Name of Your Nearest Private Hauler

DEMPSTER BROTHERS Inc.

Dept. CP-8 KNOXVILLE 17, TENNESSEE

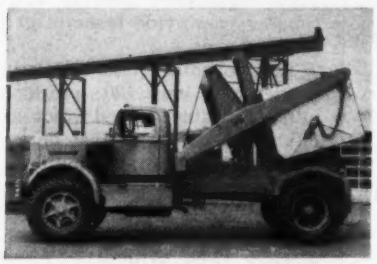
Check 5311 opposite last page.

NEW PRODUCTS



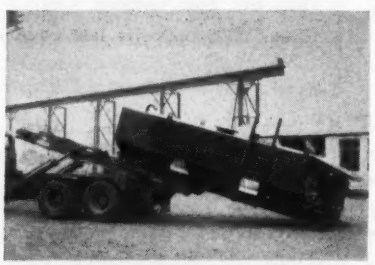
CONTAINER FOR HOT MATERIALS

This 6 cu. yd. tilt-type container was specially built to store and handle a high-temperature dusty product. It has cooling fins, a counter-balanced spring-hinged lid and a 16" sliding gate valve. When full it is picked up, hauled and emptied by a Dempster-Dumpster. Details are contained in a free brochure entitled "Special Containers." Dempster Brothers, Inc., Knoxville 17, Tenn.



NEW LFW HANDLES CONTAINERS

This new LFW 603-C, mounted on a White Mustang, was produced to handle scrap metal storage containers. It will handle containers in capacities up to 15 cu. yds. in all Dempster-Dumpster models. Lifting capacity is 18,000 lbs. Dempster Brothers, Inc., Knoxville, Tenn., offers a catalog brief No. 160 describing this and other materials handling systems.



PORTABLE FUEL OIL TANKS

This 2,000-gallon tank was produced for operation at temperatures as low as −90° F. It features its own pump and gasoline engine. Prime mover is a truck-mounted Dempster-Dinosaur which hydraulically lifts the tank into carrying position and puts it off. A new catalog section No. 12 describes the development. Dempster Brothers, Inc., Knoxville 17, Tenn.

Advertisement

Multiwalls easily opened with tug on tab

Red tab at seam of sewn open-mouth and sewn valve multiwall paper bags identifies quick-closure currently being introduced.

Tested in actual packing and shipping operations, closure has withstood ordinary stretch and breakage and sifting of

Quick-opening multiwall closure

product at seam. Protection at seam equals that of conventional closures.

Tab, measuring 3 x ⅜" is placed on factory-closed end of bag. A tug snaps tab loose and follow-through of arm frees sewing thread, literally "popping" bag open. Bag can be opened partially to form filling spout, if desired.

(Bemi-strip closure is development of Bemis Bro. Bag Company, 408 Pine St., St. Louis 2, Mo.)

Check 5312 opposite last page.

Rapid weight indication for load cell scales

Uses: High-speed electronic dial indication for load cell scales.

Features: Weight reading may be taken in less than 2½ sec from time load is positioned. Available for all of manufacturer's dial scales.

Description: Unit utilizes automatic two-speed indicator drive. Fast speed moves indicator to within few graduations of actual weight. Drive then automatically drops to slower speed to move indicator remaining distance to actual weight.

(Electronic dial is being introduced by Toledo Scale, Division of Toledo Scale Corporation, Toledo 12, Ohio.)

Check 5313 opposite last page.

Celestial 'gallery'

A "shooting gallery" which will permit scientists to simulate bombardment by celestial debris, has been delivered to Arnold Engineering Development Center at Tullahoma, Tenn.

Built by Tenney Engineering, air pressure in gallery can be reduced to the nothingness found 75 mi up.

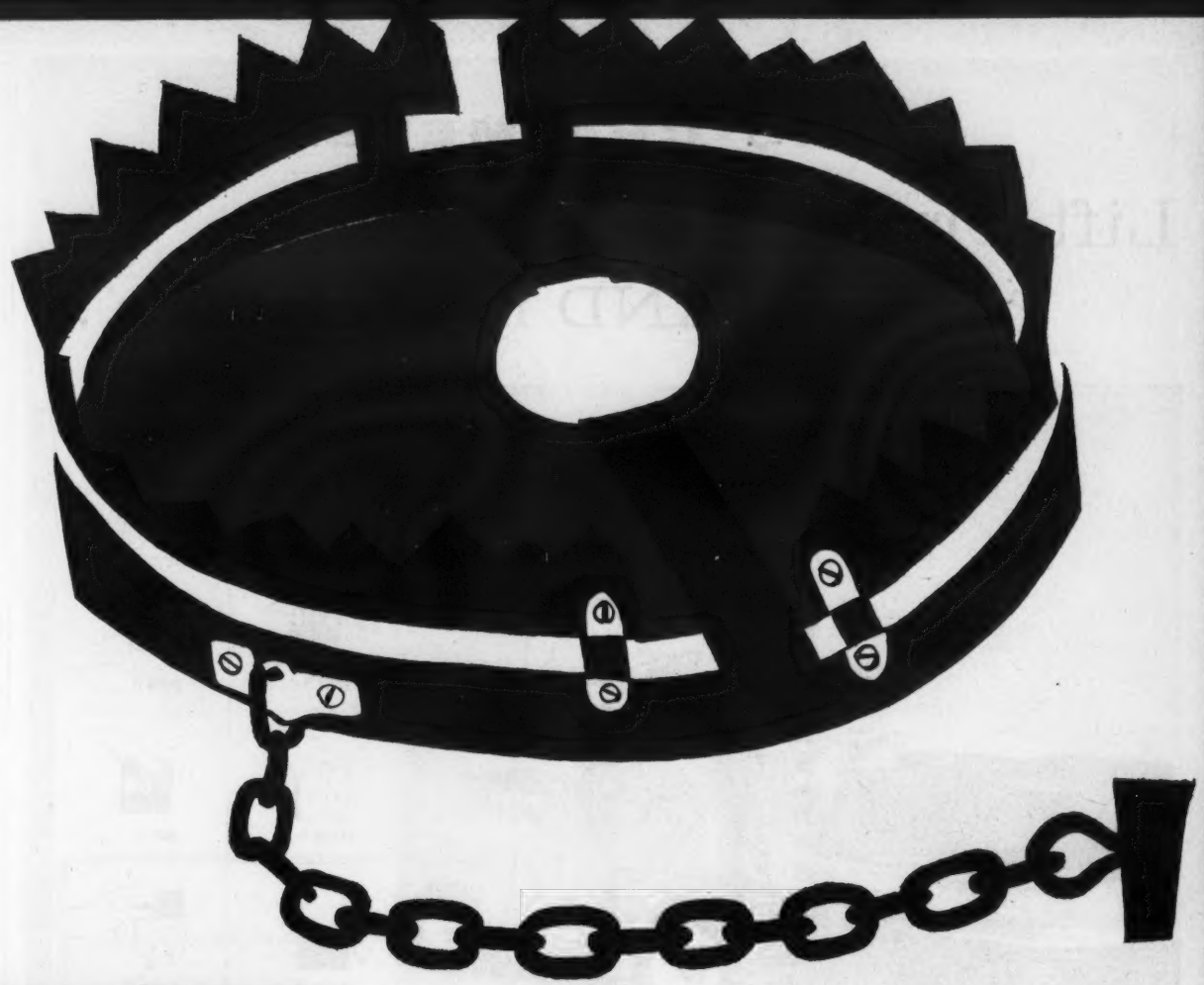
Chamber is 18′ long, 6′ in diam.

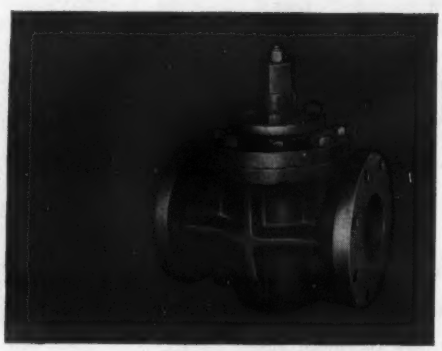
Stresses up to 100,000 lb can be exerted on target object at temp up to 1500°F.

Projectiles, representing meterorite dust and other space particles, will be fired at undisclosed velocities through evacuated 10″ tube extending 30′ out of chamber to gun arrangement.

Pay up 13% in Japan

In Japan's light electronics industry last year, there was an average wage increase of 13%. Increase averaged 10% for all industry.





acts fast: There are times when a valve must shut off NOW! That's why you'll find Rockwell-Nordstrom valves in critical operations everywhere. With their smooth, fast quarter turn action and positive shut-off they're man's best friend in an emergency. It makes a lot of sense to use these same Rockwell-Nordstrom valves in all services—they cost no more. We'll be happy to send you complete information..

ROCKWELL-Nordstrom VALVES
another fine product by
ROCKWELL

Write to:
Rockwell Manufacturing Company
104-H N. Lexington Ave.,
Pittsburgh 8, Pa.
Canadian Valve Licensee:
Peacock Brothers, Ltd.
Box 1040, Montreal, Quebec
Rockwell International, S.A.
81 Rue de la Servette
Geneva, Switzerland

Please send me Bulletin V-217.

Name_____

Company_____

Street_____

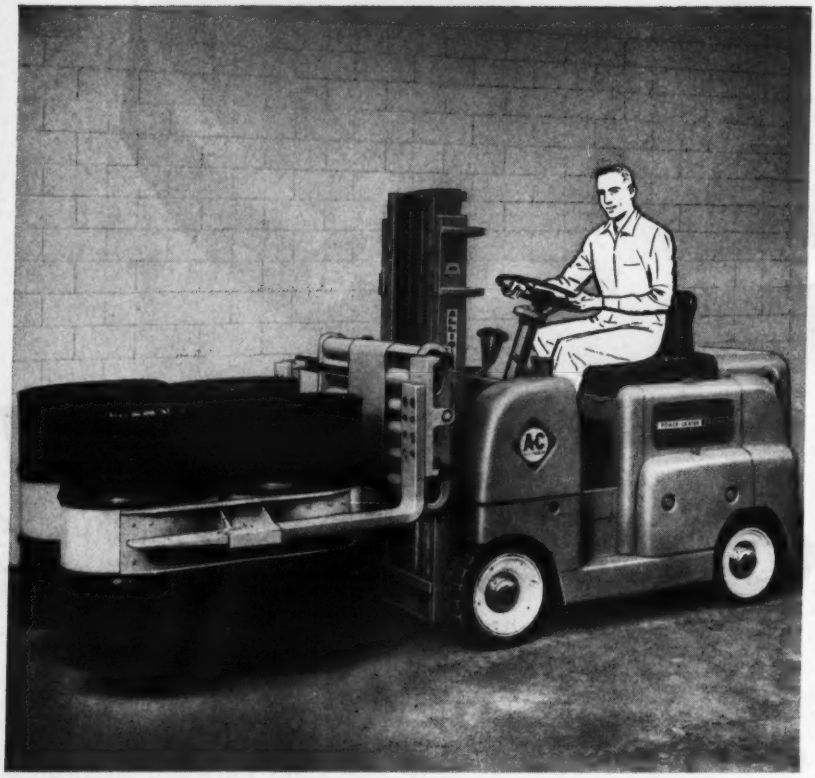
City_____ Zone____ State____

Check 5314 opposite last page.

ALLIS-CHALMERS

Lift Truck Attachments

Put the HAND in "Handling"...



These drum slip-on arms will pick up 2 or 4 drums, are ideal for close stacking, upending, transporting and dumping the contents from open-end drums.

Owners find a big dollar-saving difference in the performance, ease of servicing, and over-all durability of Allis-Chalmers lift trucks.

And these advantages are not confined to routine pallet-handling jobs, either. The full line of easy-to-mount attachments makes Allis-Chalmers lift trucks almost as flexible as your own two hands.

Have your Allis-Chalmers dealer show you how the right attachment quickly pays for itself by extending the usefulness of the lift truck — by moving a larger volume of material and by reducing damage. Allis-Chalmers, Milwaukee 1, Wisconsin.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

***POWER* FOR A GROWING WORLD**

BH-1698

Check 5315 opposite last page.

▸ A NEW SOLUTIONS ARTICLE

Using steel-belt conveyor simplifies clean-ups in plastics plant

Eliminates scrubbing; cost of replacing fabric belts

Problem: Plastic compounds were carried from blender to a calendar via a fabric belt conveyor in a large Canadian plastics plant. Since color of compound processed varied from day to day, it was necessary to remove every trace of compounds from the belt at the end of the day to prevent contamination of the next day's output.

The warm, tacky compound would get into the crevices of the woven belt aggravating the scrubbing problem. As a result of the aggressive belt-scrubbing operation, belt life was short, sometimes a matter of weeks.

Plastic compounds were delivered to the belt via chutes from the floor above and discharged over a pulley at the far end to a calender on the floor below.

Solution: The fabric belt conveyor was replaced with a steel belt conveyor. Scrubbing was eliminated. At the end of the day, the belt is simply scraped clean by lowering a transverse blade across it and running it empty for a few laps.

Steel belt carried plastic compounds from blender to calender

Belt is made of band of steel 16″ wide by 0.032″ thick.

Results: Cleaning problem has been simplified and scrubbing eliminated. By solving the replacement problem, the belt paid for itself in a short time.

As a result of its successful

experience, the company has installed a second steel-belt conveyor.

(Steel-belt conveyor is a product of Sandvik Steel Belt Conveyors, Division of Sandvik Steel, Inc., 1702 Nevins Rd., Fair Lawn, N.J.)

Check 5316 opposite last page.

Oddly-shaped hopper car hauls 104-ton payload

Uses: Transporting such materials as sulphur, salt and many plastic, chemical and petrochemical products that are contaminated by or are corrosive to steel.

Features: Covered hopper car has 104-ton capacity — highest of any covered hopper car in service — weighs 22 ton empty. "Inverted pear-shaped" cross section eliminates all corners and obstructions found in conventional cars. Aluminum construction prevents corrosion.

Description: Tubular body acts as its own support. Center sill is eliminated. This permits centerline placement of loading hatches and unloading gates which speed flow of lading in and out. Car has four compartments.

Inverted pear-shaped cross section of high-capacity aluminum covered hopper car speeds unloading of dry bulk commodities

Entire body is made of aluminum with exception of underframe elements, running boards, truck units and brakes which are of steel. Car is 56′ long, 10′ wide, and 14′ high including hatch covers.

(Center Flow covered hopper car is manufactured by ACF Industries, Inc., American Car and Foundry Division, 750 3rd Avenue, New York 17, N.Y.)

Check 5317 opposite last page.

PAYLOADER users say:—

"The maintenance on our two Model H-25's has been lower than on any loader previously used."

"Our H-25 has proved to be a real workhorse—ruggedly constructed for continuous, dependable production."

"The H-25 has now worked 2 years with no lost production time. We find PAYLOADER equipment fast and efficient with low operational maintenance cost."

"H-25 gives maximum production output under ideal or adverse conditions."

HOUGH®

THE FRANK G. HOUGH CO.
LIBERTYVILLE, ILLINOIS
SUBSIDIARY — INTERNATIONAL HARVESTER COMPANY

HOUGH, PAYLOADER, PAYMOVER, PAYLOGGER and PAY are registered trademark names of The Frank G. Hough Co., Libertyville, Illinois

Want low maintenance?

All PAYLOADER tractor-shovels are not exposed to dusty, dirty conditions, but many *are*. This is why Hough engineers take extra effort to design maximum production protection into all PAYLOADER models.

For example, this Model H-25 has dual-filtering of engine intake, individual cartridge-type filters on all three oil systems — for the engine, the hydraulics, and the torque-converter/power-shift transmission. Service brakes, hydraulic system, generator, distributor and ignition and starter switches are all sealed. In addition, more than 100 "O" rings and other seals are used on the hydraulic and mechanical systems to keep oil and grease *in* and dirt *out*.

Whatever size of PAYLOADER tractor-shovel you need, you can be sure it is designed with this same attention to production insurance. Your Hough Distributor will gladly show you how these high-production and low-maintenance features can "ease the profit squeeze" of your bulk handling.

THE FRANK G. HOUGH CO., 744 Sunnyside Ave., Libertyville, Ill.

Send "Industrial Materials Handling from A to Z"

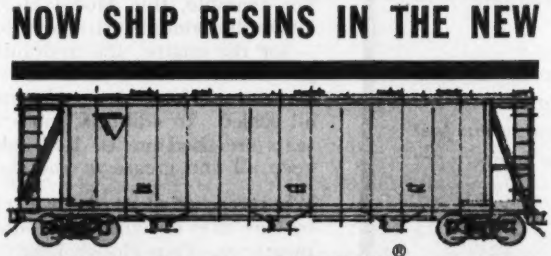
Name
Title
Company
Street
City State

7-A-1

Check 5318 opposite last page.

18 MAJOR CHEMICAL COMPANIES

NOW SHIP RESINS IN THE NEW



DRY-FLO CHEM® CAR

General American designed its new DRY-FLO CHEM Car to protect plastic resins from contamination and moisture pickup. It is being used by 18 of the major producers of polyethylene, polystyrene and polypropylene. The unique feature which makes this car better than any other for bulk transportation of contamination-sensitive, free-flowing solids is General American's patented nozzle for pneumatic unloading.

The DRY-FLO CHEM car is built with three separate compartments, each with its own nozzles and hatches. Exterior carlines—pioneered by General American—provide a smooth unbroken ceiling surface and hopper corners rounded on a 2½" radius minimize product retention inside the car.

Write for details.

Airslide® and Dry-Flo® Car Division

GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South LaSalle Street • Chicago 3, Illinois *Offices in principal cities*

DRY-FLO GENERAL AMERICAN TRADE MARK

Check 5319 opposite last page.

Oil companies test-pack foil-fiberboard can

First adopted for packaging frozen juice concentrate, foil-fiberboard container is now being tested by two oil companies for packing motor oil in quarts.

Container features multiply construction including a kraft-backed aluminum foil liner, 2 plies of kraft fiber and an outer layer of kraft-backed aluminum foil that also serves as label.

Costs are approximately 20% less than tin plate cans and about 14% less than aluminum body cans. Lighter weight permits user to trim 5-to-10% off shipping costs.

Cans are manufactured at speeds comparable to metal cans and may be run through conventional unscrambling, filling and seaming equipment at conventional metal can speeds.

(Foil-Kan containers are manufactured by R. C. Can Company, 9430 Page Ave., St. Louis 32, Mo.)

Check 5320 opposite last page.

NEW LITERATURE
Material Handling and Packaging

U.S. specifications for variety of adhesives, coatings and sealers are listed in 54-page manual which includes military specifications, specification definitions, intended applications and corresponding material for that use. Adhesives Cat — Adhesives, Coatings and Sealers Division, Minnesota Mining & Manufacturing Company.

Check 5321 opposite last page.

Extra-wide dockboards, (7'), designed to provide maximum manuevering room and eliminate dangerous working conditions, are introduced in Bul SB 811 — Kelley Company.

Check 5322 opposite last page.

Pressure-sensitive adhesives are subject of nine-page bulletin designed to aid prospective industrial users in selecting proper adhesives for specific uses. Bul 301 — Adhesive Division, National Starch and Chemical Corporation.

Check 5323 opposite last page.

Quick-change mounting plate facilitates multiple use of Viberlec vibrator.

Speed the flow of bulk materials!

Viberlec Vibrators increase production...lower operating costs!

Most efficient and economical movement of bulk materials is provided by Viberlec electric external vibrators—from the finest powders to large solid pieces—through bins, chutes and hoppers.

Compact, powerful Viberlec vibrators offer many advantages:

- Practically silent operation — little or no annoyance to employees.
- Vibrated material may be hot or cold, under pressure, vacuum or controlled humidity. It may be sterile, toxic or protected by an inert atmosphere.
- Operating parts, sealed in steel are *not* affected by dust, moisture, water, humidity, corrosive or contaminated air.
- Rugged construction for years of service.

10' cord and switch with thermal overload protection are included.

WRITE TODAY for full information!

VIBER COMPANY 726 S. Flower St. Burbank 47, California

VIBER CO

Pioneers and leaders in the manufacture of

VIBRATORS

Check 5324 opposite last page.

HANDLING & PACKAGING

Bucket elevators, including standard and closed vertical, positive-discharge, open inclined, super-capacity and double-leg crane elevators, are described and applications cited in Bucket Elevator Bul — Barber-Greene Company.

Check 5325 opposite last page.

Idlers, both trough and return, developed for general-purpose belt-conveyor installations, are subject of four-page brochure. Dimensions and weights for 4" and 5" trough- and return-idlers for belts ranging from 18 to 36" in widths are included. Bul 456-10 — Webster Manufacturing, Inc.

Check 5326 opposite last page.

Fitting the job to machine, in this case front-end loaders, is subject of eight-page booklet covering manufacturer's wheel-type and track-type loaders. Form D106 — Advertising Division, Caterpillar Tractor Co.

Check 5327 opposite last page.

Higher profits through more efficient production is announced purpose of 26-page guide prepared for manufacturer by Harvard Professor James R. Bright. Booklet explains cost reduction opportunities to be realized through corrective recognized handling measures. Management Guide To Productivity — Yale Materials Handling Division, The Yale & Towne Manufacturing Co.

Check 5328 opposite last page.

Portable splice maker, which one man can operate to splice conveyor belts, is subject of Zipper Bul — Scandura, Inc.

Check 5329 opposite last page.

Portable stapler, which is air-powered and magazine-fed, is described along with other stapling equipment in 20-page Cat 11 — Paslode Co., division of Signode Steel Strapping Company.

Check 5330 opposite last page.

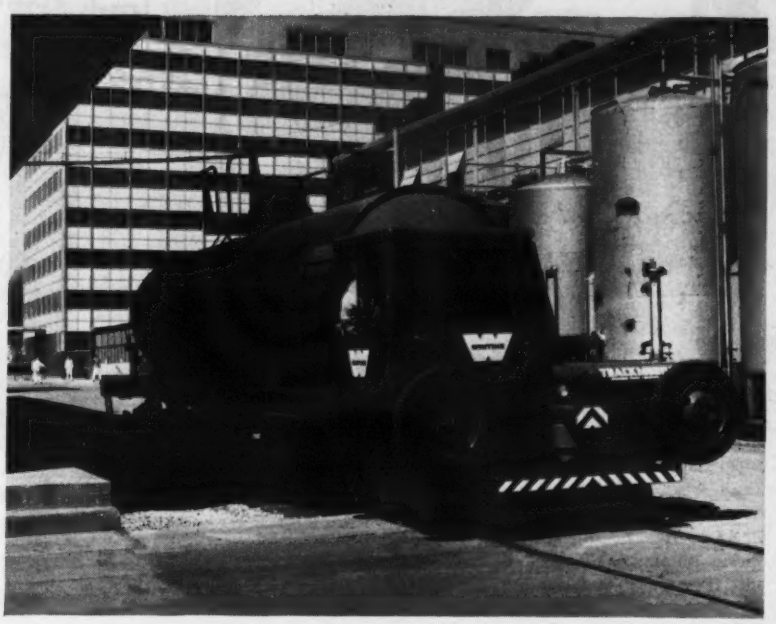
Nesting pails, which manufacturer rates "stickproof," are described and specifications given in Nesting Pail Bul — Bennett Industries, Inc.

Check 5331 opposite last page.

Conveying and rotary valves, specifically designed for handling of products through pneumatic systems in chemical, food, and bakery industries, are covered in four-page Bul CV-3-3-61 — Systems Engineering & Manufacturing Company.

Check 5332 opposite last page.

IN THE CHEMICAL PROCESSING INDUSTRY...



The lesson in this photo can save your company thousands of dollars

What's happening here? A Trackmobile is pushing a loaded tank car—a Trackmobile! Yes sir. A Trackmobile is Whiting's answer to low cost movement of rail cars in and around your plant. This vehicle switches, spots, pushes and pulls rail cars. It has an auxiliary set of road wheels. They are hydraulically lowered quickly so that the Trackmobile can run across tracks to any out-of-the-way spot for the next job. It parks anywhere.

For years, Trackmobile has been saving money for plants in your industry. They'll do your job, too—efficiently and unnoticed—unnoticed, that is, except on your profit and loss statement.

Please challenge us to show proof that a Trackmobile can save you money. Write Whiting Corporation, 15667 Lathrop Ave., Harvey, Illinois. In Canada: Whiting Corporation (Canada) Ltd., 350 Alexander Street, Welland, Ontario, Canada.

It runs on wheels | It runs on rails | It switches, spots and hauls

FREE: Write for color booklet "Tricky the Trackmobile"

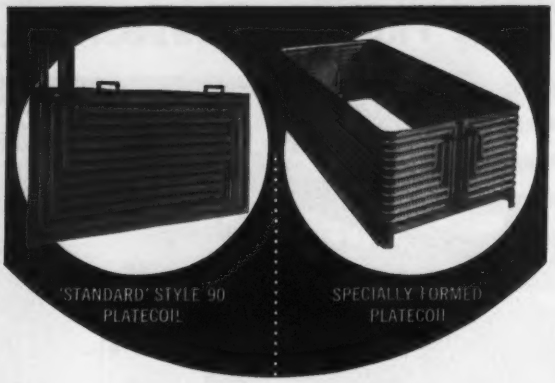
90 OF AMERICA'S "FIRST HUNDRED" CORPORATIONS ARE WHITING CUSTOMERS

TRACKMOBILE®

WHITING

MANUFACTURERS OF CRANES; TRAMBEAM® HANDLING SYSTEMS; PRESSUREGRIP; TRACKMOBILES®; FOUNDRY, RAILROAD, AND SWENSON CHEMICAL PROCESSING EQUIPMENT

Check 5333 opposite last page.



PLATECOIL®

boosts efficiency in all kinds of tank and process heating and cooling — saves on engineering, fabrication and maintenance

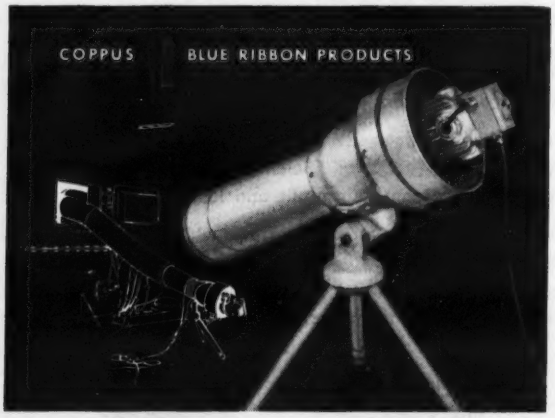
PLATECOIL can be engineered and factory-fabricated to exact specifications. Available in a wide range of standard sizes, specially formed or fabricated units, and most weldable metals. Operating pressures up to 250 psig.

"Platecoil" can be furnished to comply with ASME Code.

WRITE FOR NEW BULLETIN P54

PLATECOIL DIVISION, TRANTER MANUFACTURING, inc.
Lansing 9, Michigan

Check 5334 opposite last page.



COPPUS "Blue Ribbon" Vane Ventilators are portable and easily adaptable to practically any "fresh-air" requirement in industry. Mail coupon below for facts.

COPPUS ENGINEERING CORP.
388 Park Avenue, Worcester 10, Mass.

- ☐ in tanks, tank cars
- ☐ in underground manholes
- ☐ for exhausting welding fumes
- ☐ on boiler repair jobs
- ☐ for general man cooling
- ☐ to stir up stagnant air wherever men are working or material is drying

Name.....
Company.....
Address.....
City.....

COPPUS BLOWERS

Check 5335 opposite last page.

Fire truck responds to every fire alarm sounded from any one of Hoffmann-La Roche's 44 buildings at Nutley, N. J., operations

Special fire truck answers all alarms

A NEW FIRE truck has been placed in service by Hoffmann-La Roche Inc., in Nutley, N. J. It responds to every fire alarm sounded from any one of the 44 buildings which dot the pharmaceutical manufacturer's 100-acre tract.

The fire truck is mounted on a C550 Ford chassis. It is equipped with a 250-gal self-contained water supply, 30 gal of foam, four 20-lb carbon-dioxide portables, four 30-lb dry-chemical portables, four emergency breathing rigs, and an eight-ft collapsible ladder. It also has the usual complement of tools, nozzles, emergency lights, clothing and the like.

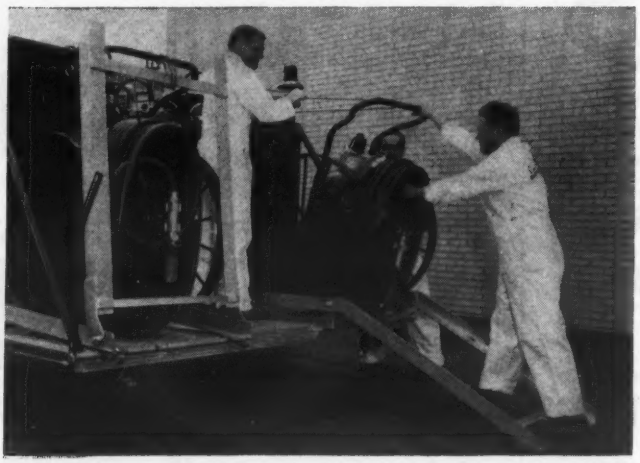
A NEW SOLUTIONS FEATURE

An unusual feature of the truck is two 200-lb wheeled dry-chemical units. Both of these are equipped with 100′ of hose. A ramp arrangement permits them to be rolled to the ground from positions on the truck's rear deck. They can be called into play for fire fighting in buildings or other areas inaccessible to the truck.

The fire truck has a single-stage pump which expels 200 gpm of liquid at 150 psi through 150′ of three-inch hose. The truck was built by Trautweins, Inc., Woodbridge, N. J.

(Extinguishers on the fire truck are product of Walter Kidde & Company, Inc., 675 Main St., Belleville 9, N. J.)

Check 5336 opposite last page.



Ramps on tail gate of truck permit 200-lb pressurized dry-chemical units to be easily removed and rolled to fire scene inaccessible to truck itself

Drilling masonry holes

. . . is offered as industrial service. Holes are drilled by company with diamond bits from ¼ to 20″ in diameter through reinforced concrete and all other masonry materials.

Drilling is done with minimum of dust and noise. Holes are drilled to any desired size without chipping or cracking. Drilling rate is up to two-inches per minute. Holes to 100′ in length can be accurately controled.

(Further information on this masonry drilling service may be obtained from Geo-Drill Company, Box 6, Bridgeville, Pa.)

Check 5337 opp. last page.

Single fitting shrinks pipe in 1/16-1″ range

Pipe-reducing adaptors, bushings, couplings and nipples are designed to eliminate multiple connections. They provide one-fitting reduction between all sizes in range of 1/16 to 1″ nominal pipe size.

Fittings are for use with pipe Schedules 40 through 80. They are available from stock in aluminum, brass, steel, Type-316 Stainless Steel, Monel, polyethylene and Zytel.

(Reducing pipe fittings are product of Cajon Machine Company, 902 E. 140th St., Cleveland 10, Ohio.)

Check 5338 opposite last page.

For more information on developments in the section, check the Reader Service Slip.

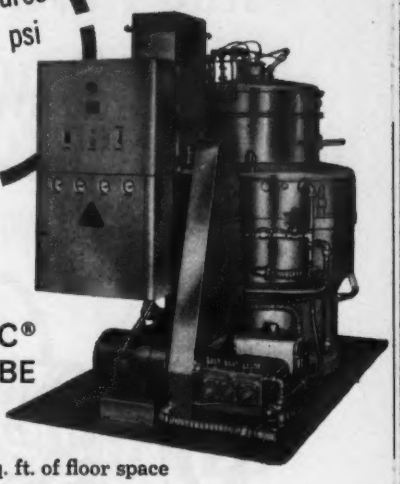
when you need . . .

- HIGH-PRESSURE STEAM
- SUPER-HEATED STEAM
- HIGH TEMPERATURE WITHOUT PRESSURE . . .

VAPOR®

HAS THE ANSWER!

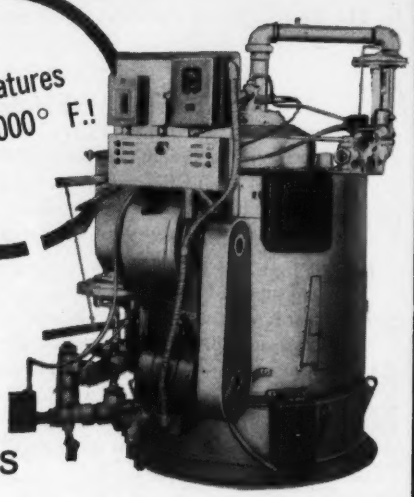
steam pressures to 900 psi or higher!



VAPOR MODULĀTIC® WATER-TUBE BOILERS

- Compact—40 sq. ft. of floor space
- Fully automatic operation
- Completely packaged, fully wired
- 18 to 150 hp
- Ideal for multiple-unit installations

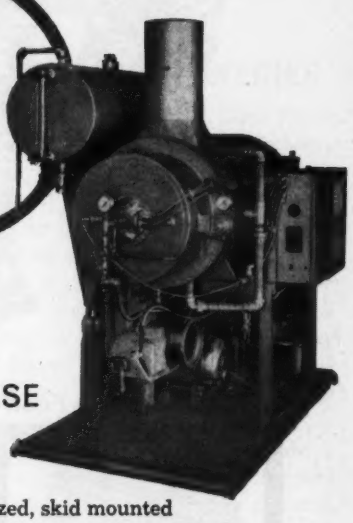
steam temperatures 600° to 1000° F.!



VAPOR STEAM SUPER-HEATERS

- Compact—16 sq. ft. of floor space
- Automatic operation
- Meets ASME and other codes
- Constant temperature control
- Completely assembled and wired

600° temperatures without pressure!



VAPOR HI-R-TEMP* LIQUID PHASE HEATER

- Completely unitized, skid mounted
- Accurate, automatic temperature controls
- Eliminates need for water treatment
- Low-pressure vessels and flow circuits
- Sizes to 13,000,000 b.t.u.

*T.M.

Send coupon today for complete information

VAPOR HEATING CORPORATION, Dept. 3-H
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Please send additional information on your:

☐ Modulātic Water-Tube Boilers

☐ Steam Superheaters

☐ Hi-R-Temp Liquid Phase Heaters

NAME_____

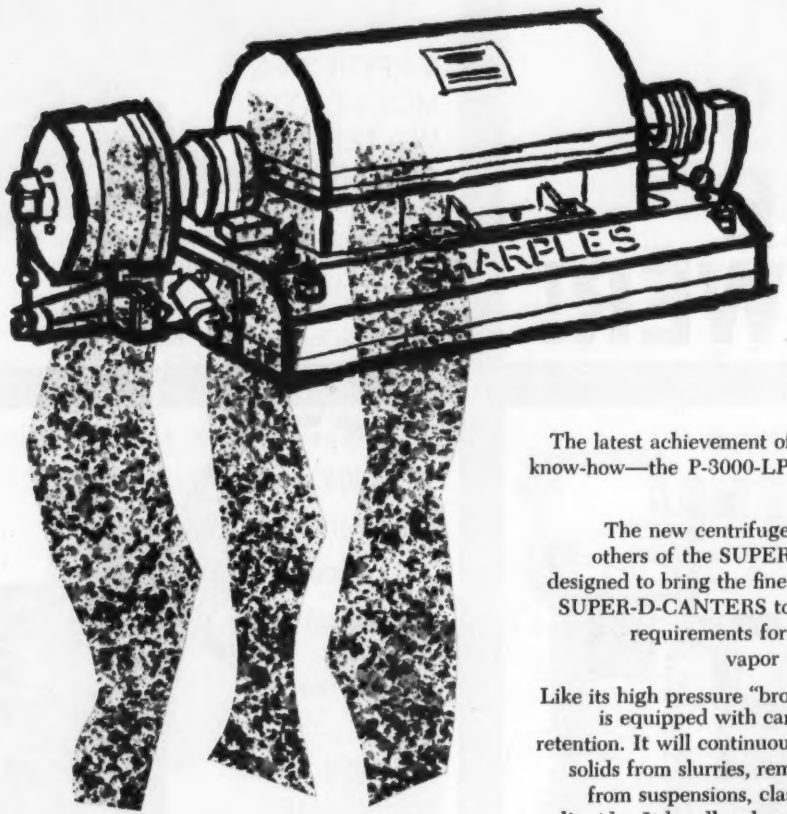
COMPANY_____

ADDRESS_____

CITY, ZONE, STATE_____

Check 5339 opposite last page.

new SHARPLES Super-D-Canter brings increased versatility to process industries



The latest achievement of Sharples engineering know-how—the P-3000-LP SUPER-D-CANTER —is now available.

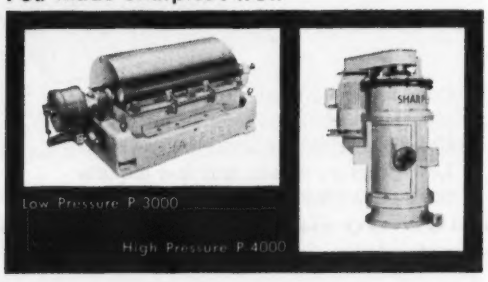
The new centrifuge—more compact than others of the SUPER-D-CANTER line—is designed to bring the fine qualities of the larger SUPER-D-CANTERS to those having specific requirements for intermediate and low vapor pressure applications.

Like its high pressure "brothers", the P-3000-LP is equipped with carbon seals for pressure retention. It will continuously recover crystalline solids from slurries, remove amorphous solids from suspensions, classify solids and clarify liquids. It handles slurries with solid contents of from ½% to 50% and solid particles from ¼ inch to a few microns in size.

A leader in the manufacture of pressurized centrifuges, Sharples also produces the high pressure vertical model P-4000 SUPER-D-CANTER designed where pressures up to 150 psi must be maintained.

The new P-3000-LP SUPER-D-CANTER is further proof of continuing progress in the processing field through Sharples Centrifugal Skill At Work. Write for complete details.

You Made Sharples *First!*



THE SHARPLES CORPORATION

Centrifugal and Process Engineers

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Associated Companies and Representatives throughout the World

Check 5340 opposite last page.

▸ A NEW SOLUTIONS ARTICLE

$560 Weld-repair job saves $6000 forging

Carefully planned and executed weld-repair of broken or damaged processing equipment is important to minimizing downtime. A case in point is that of a press cylinder at a large midwestern company in which a serious fracture developed across the outer end just behind the two heavy mounting wings. Part is a steel forging with initial cost of approximately $6000. Cylinder had wall thickness of about three inches and bore of roughly six-inch diam.

Welding procedure was as follows: First fracture was scarfed thoroughly by arc-air torch setup, with broken end

Weld-repair of this steel forging at a cost of about $560 saved the $6000 unit

completely separated from rest of the forging. The piece was set up for the scarfing.

Next a steel liner 13" wide and ¾" thick was fitted into the cylinder and allowed to project about half its width, To obtain perfect alignment.

The damaged area was preheated to 500—550°F. Then successive beads of ¼" E-6016 low-hydrogen electrode were laid down until break was filled. This work was done with part in flat position. Every fourth bead was peened. After the welding was completed, the end was heated to 550°F and soaked at that temperature for two hours. A fiber-glass blanket was wrapped around the break after heating to allow a slow cool.

The ID was bored to permit

removal of the temporary aligning band, after which another liner of hardened steel was inserted in its place. Entire bore was then honed.

Cost of repair job was approximately $560. An additional cost of $238 was incurred for honing. However, this was done as a routine procedure, and not as a result of the break. Thus, the complete repair job was carried out for less than 10% of the cost of a new cylinder unit. This would have required several months of delivery, while complete repair was accomplished in less than one week.

(Welding equipment used in above-described job is product of The Lincoln Electric Company, 22801 St. Clair Ave., Cleveland 17, Ohio.)

Check 5341 opposite last page.

Oil & water do mix . . . at least in paint

Uses: Exterior-painting applications.

Features: Linseed-oil-base paint can be thinned with water.

Description: Once dry, paint is unaffected by water and has all characteristics of a linseed-oil-base paint. Retail priced at $7.95 per gallon, paint will be available in one- and five-gal cans, and in quarts in white only. A non-chalking type is also being made available for painting trim and for tinting.

(Linseed-oil-base water-thinnable paint is product of Consolidated Chemical & Paint Mfg. Co., Inc., 456 Driggs Ave., Brooklyn, N.Y.)

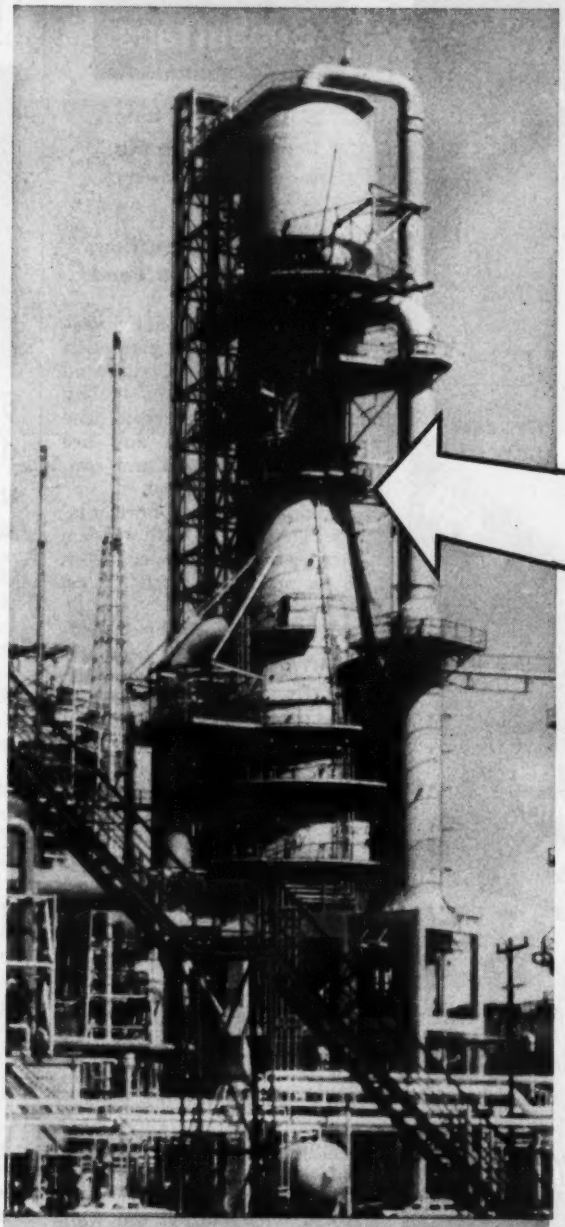
Check 5342 opposite last page.

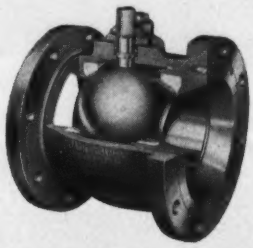
NEXT MONTH

One prime objective in fighting any tank-farm fire is to shut off supply of fuel feeding the fire. In these pages next month, an article relates how General Electric's Silicone Products Department has installed remote-operating-valve systems to provide for such shut-off.

At *CRITICAL* Valve Control Points ...You Get Dependable Operation with jamesbury "Double-Seal"™ BALL VALVES*

*PATENTED.





FIRE SAFE VALVING IN REFINERIES

The Jamesbury "Double-Seal" FIRE SAFE Ball Valve (Type DZ) has been accepted for use in the hydrocarbon industry because of its outstanding performance. In the event of fire — and the loss of the valve's soft seats, secondary metal seats provide effective shut-off of the fluid flow.

It stands to reason that a valve that performs outstandingly under adverse conditions can be relied on to give trouble-free performance under less severe conditions. That has been one of the big reasons, at least, for the success of Jamesbury "Double-Seal" Ball Valves. Proved dependable at *critical* valve control points, these valves have gone into industrial plants everywhere to control nearly all types of media flow.

There are many exclusive features about the Jamesbury "Double-Seal" Ball Valve which contribute to its excellent performance record. For example, there's Jamesbury's patented lip seal; there are no internal springs; you get leak-tight stem seals; operators are mounted integral with the valve. For further information about Jamesbury "Double-Seal" Ball Valves, contact your nearest stocking distributor — or write us direct.

WIDE RANGE OF SIZES:
Screwed end ¼" through 3".
Flanged 150# series ½" through 12" — 300# ½" through 8".
Larger sizes on request.

VARIETY OF MATERIALS:
Valves in 303 and 316 Stainless Steel, Alloy 20, Carbon Steel, Bronze, Ductile Iron, Monel, Aluminum and PVC. Interchangeable seats and seals in Teflon, Teflon compounds, Nylon, Buna-N, Neoprene, Hypalon and natural rubbers. Type DZ: Ductile Iron and Carbon Steel, Standard.
Other materials on request.

Ask For Jamesbury Fluid Services Guide

JAMESBURY CORP.
64 New Street, Worcester, Mass.
DISTRIBUTORS IN PRINCIPAL CITIES

QUARTER TURN OPERATION
HIGH FLOW CAPACITY
ZERO LEAKAGE

NO LUBRICATION REQUIRED
MINIMUM MAINTENANCE
MANUAL OR POWER OPERATION

As Versatile As Industry Itself!

174-1 ©Jamesbury Corp. 1961

Check 5343 opposite last page.

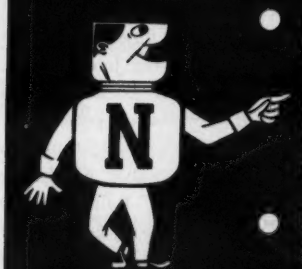
A NEW DEVELOPMENT

FOR STEAM-SAVING EFFICIENCY

Nicholson Thermostatic Steam Trap Model N-150

- ALL STEEL CONSTRUCTION
- JUST ONE WORKING PART
- RUGGED MONEL BELLOWS
- NEW BAFFLE* . . . deflects steam upward and away from the orifice to surround the bellows

- FREEZE PROOF WHEN INSTALLED VERTICALLY
- CAN BE TESTED AND INSPECTED WITHOUT BREAKING PIPE CONNECTIONS
- COMPACT, LIGHTWEIGHT, EASY TO INSTALL



- FOR TRACER LINES also Plating Tanks Platen Presses • Unit Heaters • Sterilizers and various types of Cooking and Laundry Equipment. N-150 Traps can also be used as air vents for Receivers, Water Heaters, Mechanical Traps, etc.

- W. H. NICHOLSON AND CO.
12 Oregon St., Wilkes-Barre, Pa.

* Patent applied for

Check 5344 opposite last page.

Chemical Boobytraps

Unsuspected hazards awaiting the unwary

Vessel passes inspection, then ruptures—six dead

A copper silicon-alloy vessel, which passed inspection two months earlier, ruptured releasing 1000 gal of boiling flammable hydrocarbons. The subsequent flashing and fire left six people dead and several severely burned.

Equipped with a horizontal vaporizer, 6 x 16′ with a steam bundle, this vessel operated at 38 psi and 123°C with 250 psi steam in the tubes.

At the time of the inspection, the vessel had been examined visually inside and out. A patch had been welded on the top of the wall near a nozzle because dripping acid had caused definite corrosion. The examination revealed no pitting or other corrosion and the vessel was hydrostatically tested for 60 psi and returned to service.

Gradual internal corrosion so uniform as to be indiscernable to the eye had apparently materially thinned the walls along a large area of each side. This corrosion was probably the result of water, used frequently to clean the vessel, subsequently forming an acid that attacked the alloy when ordinary products of operation did not.

It was not definitely established what caused the walls to fail at 38 psi when they withstood 60 psi two months before. Since men were working on the vessel changing a valve at the time, external stress or a blow could have caused wall, weakened by continuing corrosion, to rupture.

Safety marking colors for plants and equipment is subject of eight-page Color and Methods Bul — Industrial Maintenance Division, The Sherwin-Williams Co.

Check 5345 opposite last page.

Sturtevant Equipment NEWS

Vertical air-swept impact mill with integral air classifier

Sturtevant Pulver-Mill® does in one step what used to take two

Designed for fine grinding into the micron range and precise end product classification — all in a single operation, Sturtevant Pulver-Mills are proving highly effective for pulverizing soft to medium hard non-metallic materials. ■ *In Ag chemicals*, Pulver-Mills have helped one blue chip company enter and compete profitably in the lucrative 95% 325 mesh market . . . *In the milling field*, too, Pulver-Mills are increasing yield while also improving uniformity of particle size . . . *And pilot runs* at Sturtevant's laboratory indicate that Pulver-Mills can lower production costs, improve quality control, in the pulverizing of dozens of other materials. ■ Air-swept principle of operation (special intake vane design "whirls" vertical air flow) enables both control of attritional heat and integral air classification of end product. Precise selection of desired particle size is accomplished by an adjustable selector bar system. Unique deflector wall design "bounces" any partially reduced material back into the Pulver-Mill grinding zone — makes the reduction process (revolving impactors passing between fixed wall impactors) fast, highly efficient. ■ Now available in three models with capacities ranging from several hundred pounds per hour to 7½ tons per hour, Sturtevant will welcome the opportunity to test-run any soft to medium hard non-metallic material you may be working with.

For further information, send for Sturtevant Bulletin No. 093. Write Sturtevant Mill Co., 119 Clayton St., Boston 22, Mass.

STURTEVANT 85 years of design leadership in Air Classifiers, Micron Grinders, Pulverizers, Blenders, Crushers, Grinders.

Check 5346 opposite last page.

THAT'S INTERESTING

Leaden skies

Air over three cities—Philadelphia, Los Angeles and Cincinnati—will be investigated to determine level of lead contaminants present.

In addition lead levels in blood and urine of several population groups will be evaluated.

Purpose of double-edged study is to help develop hygienic standards for atmospheric lead and to learn more about body burden of lead in various selected population groups.

Studies are outgrowth of recommendations on tetraethyl lead made by special advisory committee to surgeon general.

Lathe cuts with liquid

A liquid lathe, resembling a cannon, delivers a neeedle point of liquid under thousands of pounds of pressure to cut through wood, cement and tough plastic.

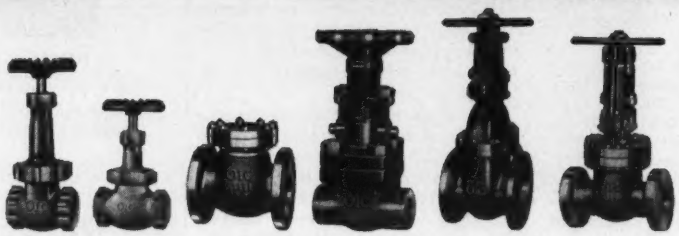
North American Aviation developed the lathe to cut solid propellant materials.

MEN WHO SPECIFY VALVES...

HEAR MORE ABOUT OIC VALVES!

SEE MORE AND MORE OIC VALVE INSTALLATIONS!

INSIST ON OIC FOR ALL VALVE APPLICATIONS!



You pay no premium for quality when you specify O I C. Special emphasis on design and manufacture . . . frequently in excess of industry specifications . . . assures you complete operational reliability, long life, reduced maintenance and easy access to vital working parts. A nation-wide distributor organization is ready and willing to advise you on the best valve for your particular application.

OIC VALVES

BRONZE, IRON, FORGED STEEL, CAST STEEL AND DUCTILE IRON VALVES

INDUSTRIAL DISTRIBUTORS THE RIGHT HAND OF PURCHASING

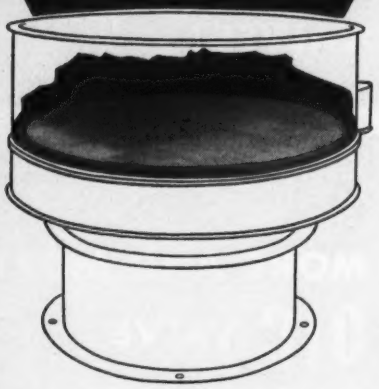
THE OHIO INJECTOR COMPANY, WADSWORTH, OHIO

Check 5347 opposite last page.

The Ohio Injector Company 10816-01
261 Main Street, Wadsworth, Ohio.
O I C quality is essential to my operations. Please send me complete information.

Name _____
Company _____
Product _____
Street _____
City _____ Zone ___ State _____

CONSIDER THESE
FACTS
about REAL
RE-SCREENING
ECONOMY



1—Rescreening your used rings costs less than buying new rings.

2—Buying SOLID RINGS which can be re-screened MOST often saves MOST dollars in the long run.

MULTI-METAL OFFERS REAL ECONOMY by

1—Re-covering New "Non-Returnable" Rings—or

2—Recovering Old Solid Rings—or

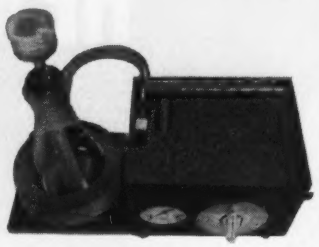
3—Furnishing New Solid Rings good for many re-screenings

Whichever you choose, let Multi-Metal help you cut replacement costs.

MULTI-METAL
WIRE CLOTH CO., INC.
1256 GARRISON AVENUE, NEW YORK 59, N. Y.

Check 5348 opposite last page.

SAFETY SLANTS



Dust detecting

. . . is function of sampler designed for use where accurate sampling of air is vital factor in control of dust or other impurities in the air. Device measures amount of dust or other foreign material on a filter surface expressed in number of particles per cu ft of air. It consists of Millipore open-face monitor with a filter on surface, electrical air pump, glass flask, and timer with automatic shut-off.

(Air contamination sampler is manufactured by Standard Valve Division, Hydraulic Research and Manufacturing Company, division of Bell Aerospace Corp., 2835 N. Naomi St., Burbank, Calif.)

Check 5349 opposite last page.

Ready for duty

. . . in on-the-spot first aid are these kits marked with large blaze-orange letters on charcoal-gray cases.

Four different kits are available for various size groups. They range from models with 10 first-aid items to kits containing 36 items. Included are compresses, bandages, iodine swabs, tourniquets, inhalants and burn salves. (First-aid kits are product of Safety Products Division, American Optical Company.)

Check 5350 opposite last page.

Fire protection methods currently used on tank truck loading racks are discussed and illustrated in Fire Protection Bul — National Foam System, Inc.

Check 5351 opposite last page.

Lightening lab load

. . . in more ways than one is fume hood molded of resistant polyesters over fiberglass, making possible a hood that is light, chemically resistant and comparatively low in price. Available in white, green or gray, hood comes complete with blower, sash and interior light. It measures 47″ wide, 29″ deep and 16″ high and can be mounted on any cabinet or table, 47 x 30″. Total weight is 175 lb. Sash is ¼″ Plexiglass coated with clear polyurethane to prevent clouding.

(Fiberglass "47" fume hood is a development of Laboratory Construction Company, 8811 Prospect, Kansas City 32, Mo.)

Check 5352 opposite last page.

▶ A NEW SOLUTIONS ARTICLE

Safe footing

. . . has been provided employees at the synthetic latex plant of the Goodyear Tire & Rubber Company in Akron, Ohio, by applying a specially prepared surface coating compound to concrete floors in locker areas.

Resin bonding agent was impregnated with aluminum oxide grits after the first coating was applied. Application of the second coat locked the grits in a tight sandwich. Evenly distributed, these provide hard, pebbly surface that allows water and moisture to drain off.

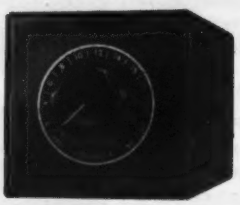
(Dura-Grip coating was supplied by Mine Safety Appliances Company, 201 North Braddock Ave., Pittsburgh 8, Pa.)

Check 5353 opposite last page.

NEW Thermocouple Selector Switches

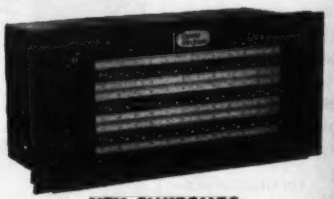
For fast, accurate indication of temperature from a number of thermocouples—to average readings from several measuring points—or to switch a thermocouple from one instrument to another—choose a new compact Thermo Electric Selector Switch.

These switches are compatible with any thermocouple or resistance thermometer, and any measuring instrument. Steel cases are dust and moisture proof, and are easily mounted on panel, rack, wall, or table.



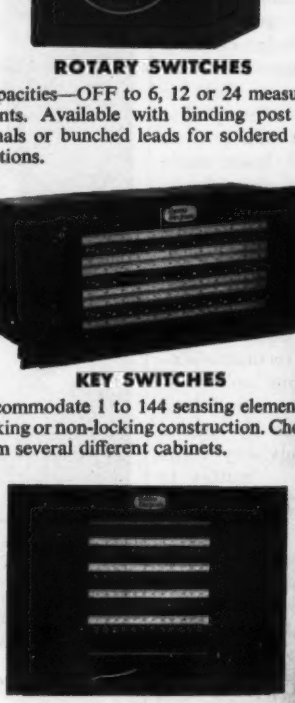
ROTARY SWITCHES

Capacities—OFF to 6, 12 or 24 measuring points. Available with binding post terminals or bunched leads for soldered connections.



KEY SWITCHES

Accommodate 1 to 144 sensing elements—locking or non-locking construction. Choose from several different cabinets.



PUSH BUTTON SWITCHES

OFF to 72 points—interlocking construction so that one switch remains "on" until another is actuated.

Write today for catalog 24-5

Thermo Electric CO., INC.
SADDLE BROOK, NEW JERSEY
In Canada: THERMO ELECTRIC (Canada) LTD., Brampton, Ont.

Check 5354 opposite last page.

you can see the sense to

HILLS-McCANNA Ball Valve Design

. . . the only ball valves available for service to 1000° F!

WEAR LIFE is remarkable because there is no metal-to-metal contact. The ball is cradled snugly between two non-metallic seats. No lubricant is required.

DIRT OR SCALE CAN'T PREVENT TIGHT SHUTOFF—the ball is wiped clean each time the valve is operated.

LEAKTIGHT STEM SEALING safely contains toxic, corrosive, or flammable fluids.

TWO-WAY SHUTOFF is provided by double seats. It doesn't matter which way the valve is installed in the line.

MINIMUM PRESSURE DROP because of the big, round, turbulence-free flow area through the ball. Smaller valves will do the job.

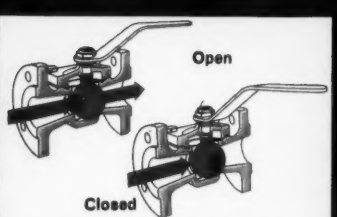
A COMPLETE LINE—1/4" through 12" . . . screwed, socket weld, or flanged ends . . . for temperatures from −150° to 1000° F . . . pressures from 10^{-6} mm Hg to 1000 psig.

ASK FOR NEW CATALOG No. 1200—complete specifications, temperature-pressure relationships, C_V values, dimensions, weights, materials, and service recommendations. You can select the valves you need directly from its pages. Send for your copy today.

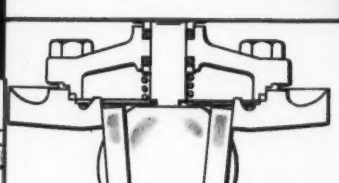
McCannaseal® top-entry valves. Flanged-end models meet applicable API and ASA specifications. Patent applied for.

McCannaflo® valves of metal or heavy-duty PVC construction.

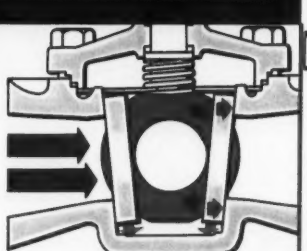
PERFECT FOR AUTOMATIC AND REMOTE CONTROL— economical, compact, fast-acting, reliable—a complete line of air-operated valves for every job.



QUARTER-TURN OPERATION — When the hole in the ball is in line with the pipe, the valve is wide open. A quarter-turn closes it completely.



STEM SEALING IS SOLVED—Two seals are maintained under constant compression by the stem nut which can be tightened to compensate for wear. The lower seal is back-seated so that line pressure works with it to prevent leakage.



NO FLOW LEAKAGE—When the valve is shut off, line pressure forces the "floating" ball tightly against the downstream seat. The seat seals against the valve body. The higher the pressure, the tighter the closure.

AUTOMATIC WEAR TAKE-UP prolongs McCannaseal valve service life. As wear occurs, ball and seats are snugged down into "wedge" by corrosion-resistant, nonflexing, nontorsional spring.

HILLS-McCANNA COMPANY

400 MAPLE AVENUE, CARPENTERSVILLE, ILLINOIS

Valves and parts stocked nationwide by leading industrial distributors

What these valves really control is cost!

you can see the sense to

HILLS-McCANNA Diaphragm Valve Design

. . . now, with the most extensive line of lowest cost operators available!

When you look into a Hills-McCanna diaphragm valve, you immediately see that all of the working parts are sealed off by the tough resilient diaphragm which also serves to control the flow. Consider the operating advantages:

LEAKTIGHT SHUTOFF—even against solid particles which might lodge on the seat.

NO CONTAMINATION OF FLOW—especially important with foods, syrups, antibiotics, or any sanitary application.

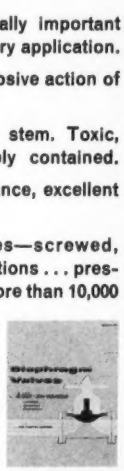
PROTECTION of working parts against corrosive action of acids, alkalies, other materials.

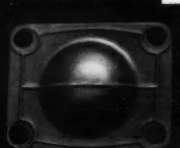
NO PACKING, hence no leakage around stem. Toxic, corrosive, and flammable fluids are safely contained.

SELF-CLEANING DESIGN, simple maintenance, excellent throttling control.

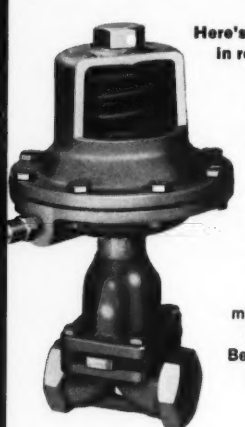
COMPLETE LINE—1/2″ through 16″ sizes—screwed, flanged, socket weld, and other end connections . . . pressures to 150 psig, temperatures to 400° F . . . more than 10,000 combinations of bodies, bonnet assemblies, and diaphragm materials to fit your service needs.

ASK FOR CATALOG No. 104 giving complete specifications and service recommendations.





SUPERIOR DIAPHRAGM DESIGN—patented sealing bead prevents leaks where others fail. Less closure force is required, longer life is insured. Available materials include reinforced elastomerics and solid plastics.



Here's real economy in remote control!

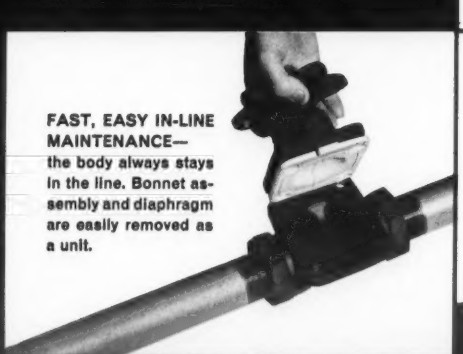
The low cost, high reliability, and compact size of Hills-McCanna air-operated diaphragm valves make them an outstanding buy for automatic and remote control service. Be sure to ask for Bulletin 134-A.

HILLS-McCANNA COMPANY

400 MAPLE AVENUE, CARPENTERSVILLE, ILLINOIS

Valves and parts stocked nationwide by leading industrial distributors

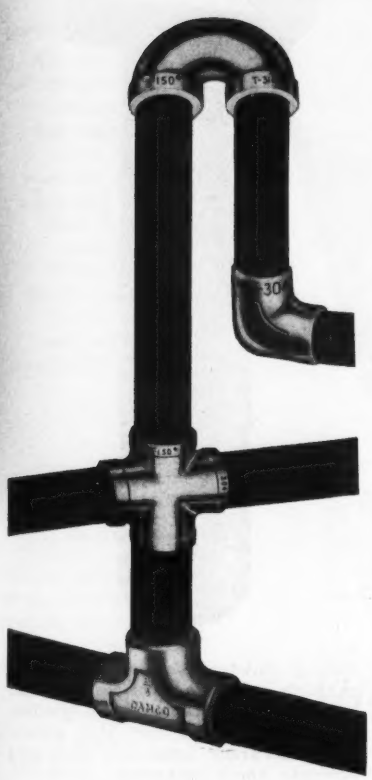
What these valves really control · is cost!



FAST, EASY IN-LINE MAINTENANCE—the body always stays in the line. Bonnet assembly and diaphragm are easily removed as a unit.

DOUBLE PROTECTION against leakage of hazardous fluids provided by outside stem and yoke or semisealed bonnets.

The most Dependable Source for Stainless Steel and Forged Steel Fittings



CAMCO
Screwed & Socketweld
FITTINGS

• 150 Lb. through 6000 Lb. Stainless Steel Screwed and Socketweld Fittings • 2000 Lb. through 6000 Lb. Forged Steel Screwed and Socketweld Fittings • Extra Heavy Stainless and Forged Steel Unions • Light Weight Forged Steel Back-Up Flanges for use with Schedules 5 and 10 Stainless Piping.

CAMCO FITTINGS, INC.
301 State St., No. Haven, Conn.

Send for Complete Catalog and NEW Price List

SEE YOUR SPECIFICATIONS IN VSMF THE MICROFILM CATALOG FILE

Check 5355 opposite last page.

A 3/8-hp electric motor subs for 1-hp compressor in airless paint sprayer

Uses: Spraying all types of paint.

Features: Spraying units utilizes 3/8-hp electric motor rather than 1-hp air compressor. Thus it can be used where air is not available.

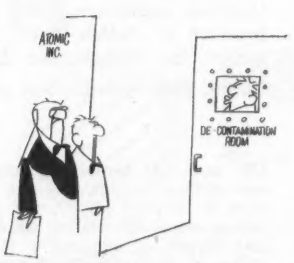
Description: Airless paint-spray unit does not need heat. Its motor operates both pump and built-in paint agitator. Instant fluid pressure is provided at spray gun as soon as motor is started.

Airless spray-paint unit has motor which operates both pump and built-in paint agitator. Instant fluid pressure is provided at spray gun as soon as motor is started

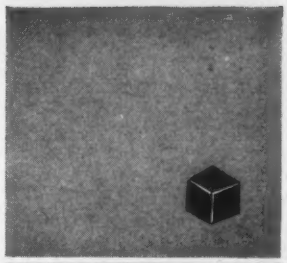
There is no air or fluid pressure on paint container. Container has five-gal capacity. No spray-booth or exhaust equipment is needed. Sprayer delivers up to one gpm of paint fluid.

(Further information on E-HY 50 electric airless paint-spray unit is available from S&S Engineering Co., Box 158, Northville, Mich.)

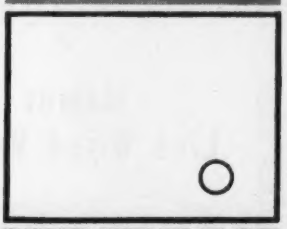
Check 5356 opposite last page.



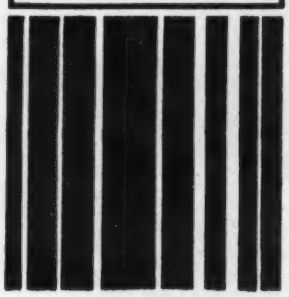
"We found limburger in his lunchbox."



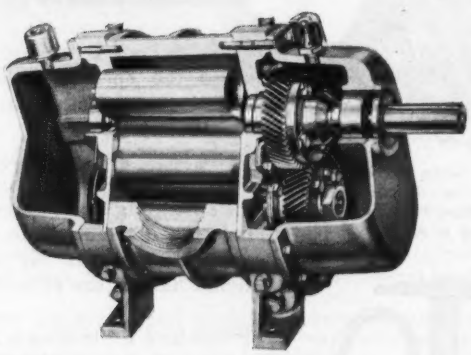
SMALLEST CUBE DIMENSIONS

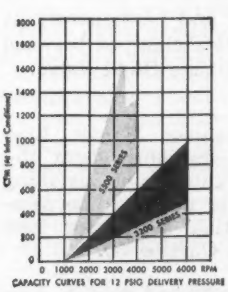


LIGHTEST WEIGHT



WIDEST PRESSURE RANGE





WITH M-D 3-LOBE BLOWERS

If space and weight of the blower is a concern in your design problem, consider this fact. M-D rotary positive blowers because of their unique 3-lobe design require smaller cubic space than any other blowers. A survey shows that a 14 PSI M-D takes 3/4 to less than 1/10 the space of competitive models . . . and in some cases are only 1/10 the weight.

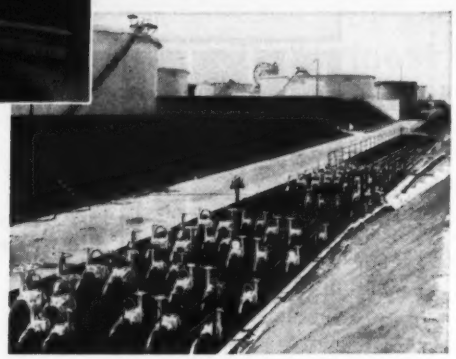
M-D Blowers operate at wider pressure and speed ranges than any other rotary positive blower. Capacities of 30 production models range from 30 to 4000 CFM, pressures to 15 PSIG single, 70 PSIG multi-stage.

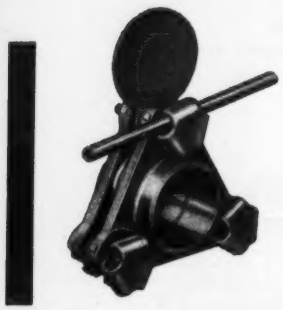
For full information write
M-D BLOWERS, INC., RACINE, WISCONSIN
A SUBSIDIARY OF MIEHLE-GOSS-DEXTER, INC.

Check 5358 opposite last page.

FAST, EASY, POSITIVE LINE BLINDING

Hamer Line Blind Valves





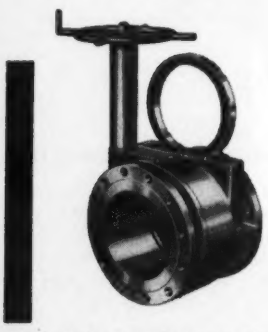
The famous 3-Bolt Hamer Line Blind Valve has set the standard for positive, dependable, economical line blinding in all industries.

FAST . . . because one man can reverse the spectacle plate from open to closed position in a matter of minutes.

EASY . . . because bar or handwheel operation provides tremendous leverage for spreading and tightening the hubs that hold the spectacle plate. Wedges, hammers, wrenches needed for spreading conventional flanges are eliminated.

POSITIVE . . . because nothing seals as securely and permanently as the solid spectacle plate clamped between the hubs of a Hamer Line Blind Valve.

Ask your nearest Hamer Line Blind Valve specialist about the multiple advantages of installing them wherever positive line shut-off is essential. Write for new Hamer Valve Catalog 60.



Handwheel operated Hamer Rigid Type Line Blind Valves are ideal for installation where conditions prevent spreading the line to reverse the spectacle plate.

WECO

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS
Division of CHIKSAN COMPANY *a subsidiary of* FOOD MACHINERY AND CHEMICAL CORPORATION

HV-2-60

fmc

WECO UNIONS

CHIKSAN SWIVEL JOINTS

HAMER LINE BLIND VALVES

HAMER PLUG VALVES

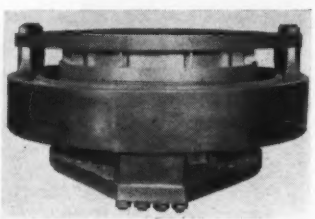
Check 5359 opposite last page.

Multi-plane movements do not cramp style of expansion joints

Uses: Absorbing angular rotation created by pipe and equipment expansion.

Features: Expansion joints absorb angular rotation in all planes.

Description: Each gimbal expansion joint is controlled by a structural system consisting of two sets of hinges, oriented at 90° apart, coupled to a common gimbal ring. This structure restricts expansion joints to angular rotation in any plane, absorbs pressures thrust and limits tortional loading on the bellows.



Each gimbal expansion joint is controlled by a structural system consisting of two sets of hinges, oriented at 90° apart, coupled to a common gimbal ring

Joints are most frequently applied in sets of two, so that expansion-joint system can absorb lateral deflection in any plane. Since amount of lateral deflection which can be absorbed by system is directly proportional to distance between two expansion joints, a good deal of design flexibility is available.

Three basic types of joints are available to meet requirements of movement, pressure and temperature.

(Gimbal expansion joints are product of Zallea Bros., 815 Locust St., Wilmington, Del.)

Check 5360 opposite last page.

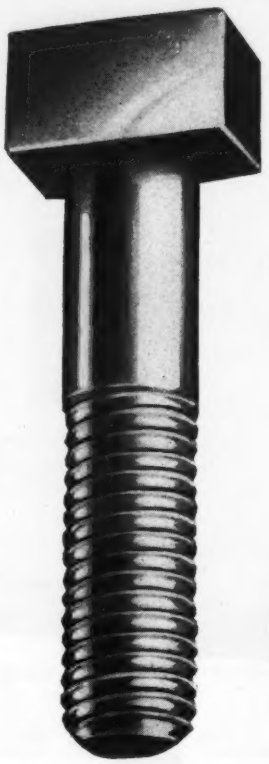
DC and AC motors, generators and control equipment are all covered in 48-page publication illustrating electrical rotating machines and variety of equipment. "Catechism of Electrical Machinery"—Electrical Division, Fairbanks, Morse & Co.

Check 5361 opposite last page.

lower cost

TEE BOLTS

by an exclusive method



Among Pawtucket's many specialty products are these lower-cost tee-head bolts. Pawtucket's exclusive production method keeps cost low, dimensional accuracy unusually high and strength above standard.

Pawtucket tee head bolts are made in standard sizes ¼" and larger, or to your specifications. In any size, you can depend on a uniform Class 3 fit, if required.

All standard steels, stainless steels and nonferrous metals, including Titanium

FOR THREADED SPECIALTIES . . .

PAWTUCKET

MANUFACTURING COMPANY
327 Pine St. • Pawtucket, R. I.
THE PLACE TO SOLVE YOUR BOLT PROBLEMS
"The Bolt Man" T.M. REG.

Check 5362 opposite last page.

THAT'S INTERESTING

Fallout levels up

Continuing increase during past two yr of radioactive fallout levels in man, other animals and foods is reported by AEC.

Accumulation of longer-lived contaminating elements from both weapons testing and nuclear development is believed to be the cause. Levels are well within acceptable limits.

Conductor is super

Superconductor material developed by Atomics International offers no resistance to electrical current.

In tests, wire has delivered equivalent of 100,000 w from 110v wall outlet.

Material is a cold-worked alloy comprised of approximately three parts of niobium to one part of zirconium.

For more information on product at right, specify 5363 see information request blank opposite last page.

solve the processing puzzle WITH EASTERN CENTRIFUGAL PUMPS

In every detail of size, weight, space requirements, materials, power and costs, Eastern Centrifugal Pumps are made to match strict process requirements.

- **PRESSURES:** to 21 psi in single stage pumps; to 70 psi in multi-stage types
- **FLOWS:** capacities to 70 gpm in single-stage pumps, to 10 gpm for many multi-stage models
- **MOTORS:** standard motors for 115/230-volts 60 cycles 1 phase (other electrical characteristics available). Power range from ⅛ to 1½ H.P.
- **ENCLOSURES:** drip-proof, totally enclosed, and explosion-proof ball-bearing frames
- **DRIVES:** all models available in belt or coupling drive with ball-bearing equipped stands. Space-saving close-coupled pumps most rugged and popular — but many pedestal models also available
- **SEALS:** a variety of rotary seals and stuffing boxes, to fit every application
- **METALS:** your option of cast iron, bronze, stainless steel (18-8 type 303 and 316) Monel, Cast Iron, Hastelloy "C"
- **INSTALLATIONS:** a wide range of transfer, recirculation, feed, boost, and filter-pumping applications

TO FIND OUT: write for the brand-new Centrifugal Pump Catalog — Bulletin 130. Here are all the models — including useful engineering data.

For a complete review of positive displacement pumps for non-lubricating fluids, write for Bulletin 220. Eastern Bulletin 400 is your guide to a broad line of midget-centrifugal pumps and stirrers for the laboratory.

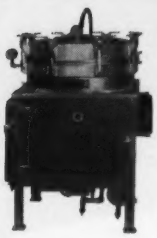
EASTERN INDUSTRIES PUMP DIVISION

EASTERN INDUSTRIES, INCORPORATED

100 SKIFF STREET • HAMDEN, CONNECTICUT
West Coast Office: 4203 Spencer St. • Torrance, Calif.

Other Eastern products: • hydraulic motors • gear pumps • positive displacement pumps • aircraft pumps

YOU GET *Lower* VACUUM PUMP MAINTENANCE *Costs* and INCREASED VACUUM with the **HILCO** OIL RECLAIMER



HILCO OIL RECLAIMER

For complete oil reclaiming. Removes solids, acids and volatile impurities; moisture, solvents, gases, etc. by heat-vacuum process.

A simple, economical and efficient method of restoring contaminated lubricating and sealing oil to the full value of NEW OIL. The HILCO will produce and maintain oil free of solids, water, gums and acids in a continuous, all-electric, automatic operation.

★ ***Be Sure of CLEAN OIL in Your High Vacuum Pumps***

KEEP YOUR HYDRAULIC SYSTEM *Clean* with **HILCO** HYDRAULIC OIL FILTERS

- **No More Varnish and Sludge Deposits**
- **No More Flushing and Manual Cleaning**
- **No More Frequent Oil Changes**
- **No More Accumulation of Dirt**

Filter life up to a year eliminates usual frequent draining, refilling of systems.

★ ***Write for complete details in the free bulletin at no obligation . . .***

The HILLIARD Corporation
58 WEST FOURTH ST. ELMIRA, N. Y.

In Canada:
UPTON-BRADEEN-JAMES LTD.

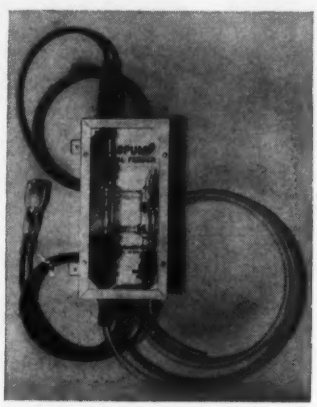
Check 5364 opposite last page.

Stopcock-lubrication snare unmet by users of feeder for chemical treatment

Uses: Pumping chemical treatment into cooling towers, evaporator condensers or other unpressurized water systems, for control and prevention of development of algae and other bacteriological formations.

Features: Feeder incorporates Teflon stopcock which is unbreakable and does not require lubrication.

Description: Removable, heavy-wall-glass chemical feeder is housed in compact anodized-aluminum case.



Removable heavy-wall-glass chemical feeder is housed in compact anodized-aluminum case

Flow-control valve permits ¾ gpm at line pressures to 125 psi. Check valve prevents back flow into chemicals. There are no moving parts.

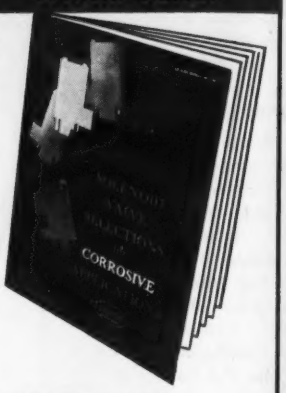
(Glaspump chemical feeder is product of California Scientific Glass Company, 9811 E. Rush Street, El Monte, California.)

Check 5365 opposite last page.

Semi-steel valves and accessories are reviewed in 44-page bulletin. Specifications and dimensions are given for all sizes of semi-steel straightway, steam-jacketed, multiport and special-order valves. Accessories covered are wrenches, locking devices, extensions, lubricants and a lubricating gun. Bul V-203 REV-1—Nordstrom Valve Division, Rockwell Manufacturing Company.

Check 5366 opposite last page.

FREE SOLENOID VALVE DATA! ...from Valcor



"HOW TO SPECIFY SOLENOID VALVES", an 8-page brochure complete with drawings, diagrams, charts and curves . . . and **"SOLENOID VALVE SELECTIONS FOR CORROSIVE APPLICATIONS"**, a 16-page manual listing over 500 corrosive media. Both are free. Both should be at your fingertips.

Write today for your copies!

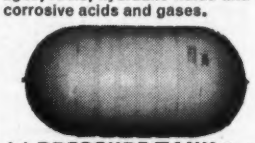
VALCOR SOLENOID VALVES **VALCOR ENGINEERING CORP.**

5392 Carnegie Avenue • Kenilworth, New Jersey

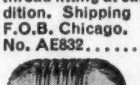
Check 5367 opposite last page.

FLUID & GAS PRESSURE TANKS
STAINLESS & CARBON STEEL TANKS
(GOVERNMENT SURPLUS BARGAINS)

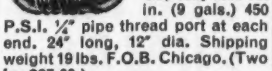
Steel tanks for the handling, storage and transportation of gases, beverages, fuels, hydraulic fluids and other liquids. Stainless steel tanks for corrosive acids and gases.



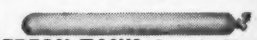
J-1 PRESSURE TANK Stainless steel, surplus aircraft oxygen tank. 48" long, 24" dia. Rated for 400 P.S.I. working pressure, 18,000 cu. in. vol., 77.9 gal. capacity. ¼" pipe thread fitting at each end. New condition. Shipping weight 247 lbs. F.O.B. Chicago.
No. AE832.....$99.50



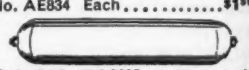
G-1 TANK Stainless steel. Capacity 2100 cu. in. (9 gals.) 450 P.S.I. ¼" pipe thread port at each end. 24" long, 12" dia. Shipping weight 19 lbs. F.O.B. Chicago. (Two for $27.00.)
No. AE63 Each.....$14.95



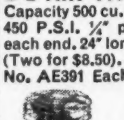
NON-SHATTERABLE CO_2 CYLINDER This type of pressure bottle was used by the Armed Forces for inflating life rafts. 18¼" long, 3¾" dia. Has ½" pipe thread opening at one end. Capacity 2.98 lbs. of CO_2—at 1800 P.S.I. Shipping weight 10 lbs. F.O.B. Chicago.
No. AE303.....$2.50



FREON TANK Capacity 22 oz. of Freon F22, 6 cc Methyl Alcohol. 18¼" long, 2" dia. ¾" pipe thread opening at one end. Equipped with brass valve. Shipping weight 3 lbs. F.O.B. Chicago. (Six for $8.00).
No. AE834 Each.....$1.99



D-2 AIR TANK Carbon steel. Capacity 500 cu. in. (approx. 2 gals.) 450 P.S.I. ¼" pipe thread port at each end. 24" long, 6" dia. Postpaid. (Two for $8.50).
No. AE391 Each.....$4.95



CORNELIUS HIGH PRESSURE (1500-2000 P.S.I.) AIR COMPRESSOR Three cylinder, 3-stage compressor, complete with 27 volt, D.C. 20 amp. motor, with fan. Rated 1500 P.S.I. continuous duty, 2000 P.S.I. intermittent. Pressure switch in base. As released by Air Force, in used, serviceable condition. Covered by our 30 day GUARANTEE. 11½" long, 7" high, 9" wide. Shipping weight 12 lbs. F.O.B. Chicago. Limited quantity.
No. AE549.....$35.00

Write today for FREE CATALOG of other EQUIPMENT BARGAINS!

GROBAN SUPPLY COMPANY
1139 SOUTH WABASH AVE., DEPT. AE-8, CHICAGO 5, ILL. WEbster 9-3793

Check 5368 opposite last page.

THAT'S INTERESTING

Coating cuts launch cost

A flexible insulative coating may help to hold back soaring costs of U.S. missile program.

In test with Atlas ICBM, coating was used to protect launch pad and other ground equipment exposed to rocket blast.

Ordinarily, pad and equipment have to be refurbished and repaired or replaced following each launching.

Tests showed many items, protected by coating, could be used over and over again.

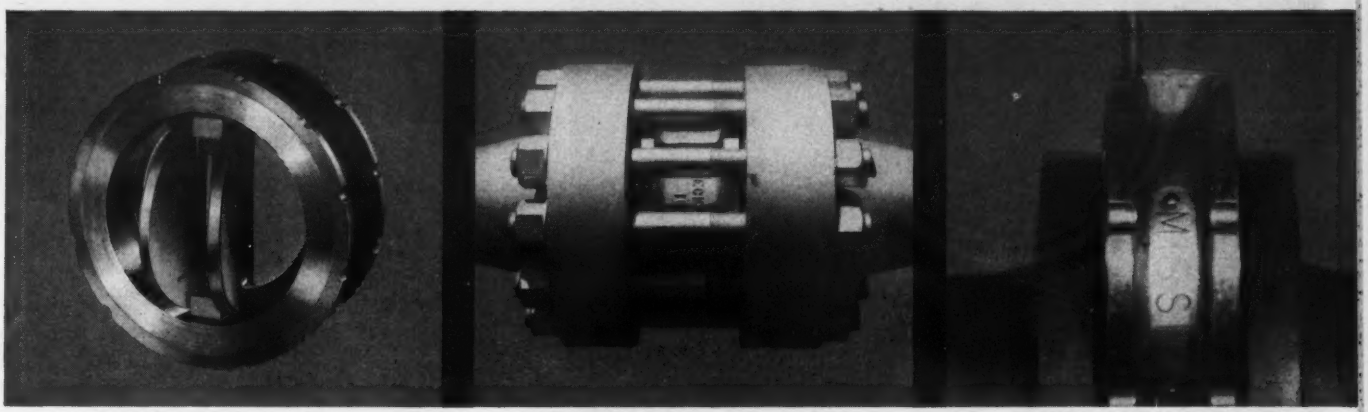
Material is itumescent coating containing phosphates and boron flameproofing chemicals dispersed in a flexible polyurethane binder.

Coatings are applied to components at the launch site by brush or spray.

It is produced by Dyna-Therm Chemical Corp.

For more information on product at right, specify 5369 see information request blank opposite last page.

COSTS LESS—WEIGHS LESS—EASY TO INSTALL

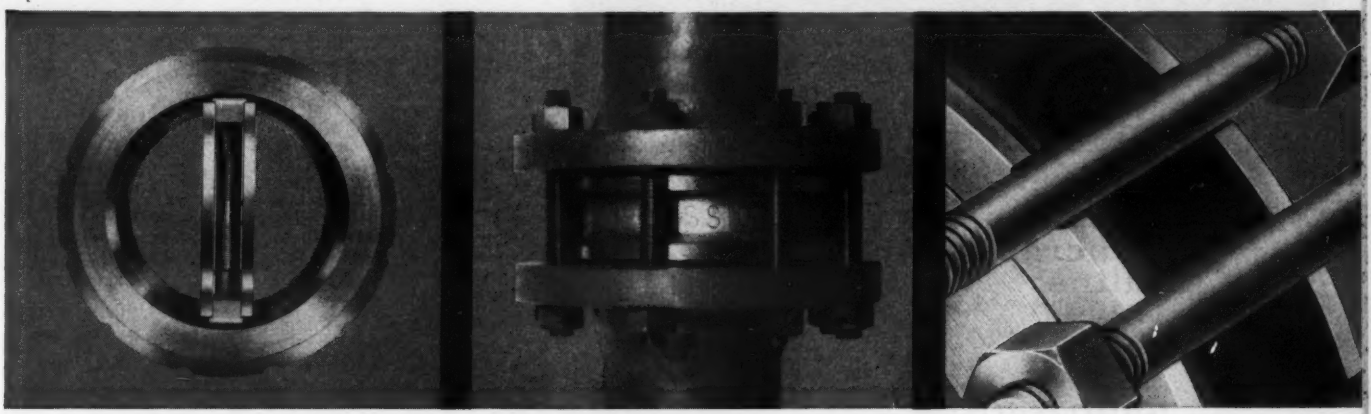


Because of its sound, imaginative design, the Duo-Chek check valve is smaller, uses less material, and costs less to buy. It costs less to maintain and lasts longer, too.

A Duo-Chek check valve weighs on the average less than ten per cent, with some models weighing only two per cent, as much as conventional check valves for the same service. No foundations are needed.

The Duo-Chek fits between the flanges, is smaller and weighs less. For example, a 6-inch steel valve, series 300, weighs 29 lbs., requires no special installation equipment.

NO SLAM—ANY POSITION—CUTS INVENTORY



A stainless steel coil spring effects positive sealing action. The quick action of the spring closes the valve before reverse flow can occur. Result: No slam, no water hammer.

The Duo-Chek simplifies piping arrangements. The spring loaded plates operate in any position. Most popular sizes can be installed even in vertical lines with downward flow.

The unique versatility of the Duo-Chek greatly reduces inventory. In sizes 2 through 12 inch, one valve fits both series 150 and 300 flanges; 2- and 3-inch sizes fit series 600, too.

MISSION **DUO-CHEK** CHECK VALVE

The Mission Duo-Chek® check valve performs all regular check valve duties, yet is smaller, lighter, and easier to install. Duo-Chek check valves are available in a complete range of sizes from 2 to 48 inches, ASA Series 125 through 2500. They come in various end connections, such as raised face, ring joint, weld neck, etc. They are made in carbon steel, stainless steel, aluminum, and bronze. Special alloys are available. Because of the small size of the Duo-Chek, special alloy valves cost much less than conventional valves in the same alloy.

Sealing material is bonded in a groove in the plate. The sealing material makes an O-ring seal, which pressure deforms until metal-to-metal contact is made by the plate and body seat. Sealing material may be Buna-N, Teflon, Viton, or metal, depending on the service.

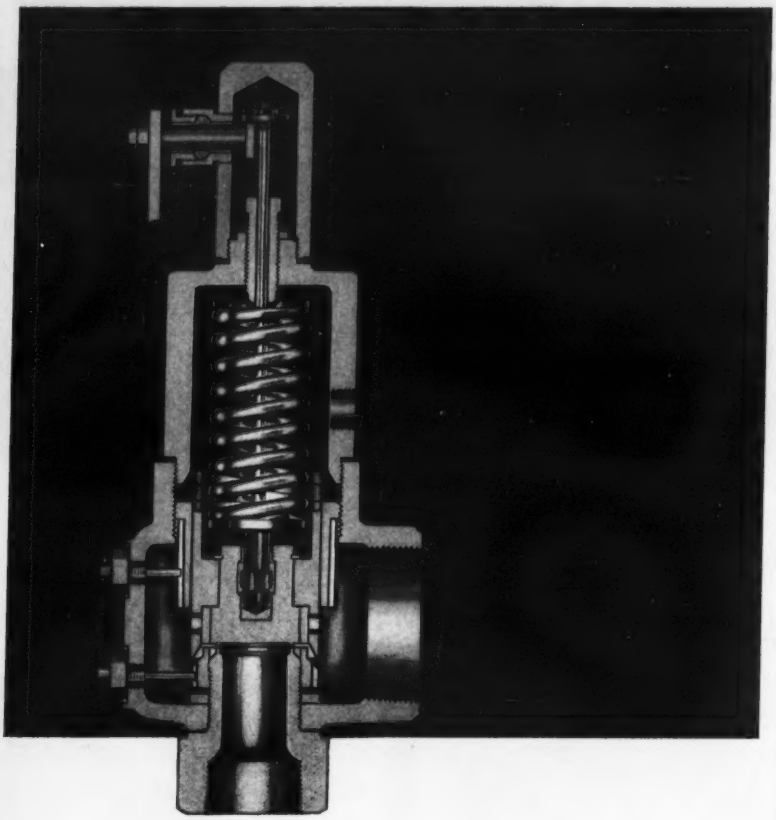
The simplicity of design of the Duo-Chek pays off in every installation with longer life and less maintenance. Only six parts are contained within the body of the Duo-Chek, held without the use of internal fasteners or joints of any kind. All parts are interchangeable.

The Duo-Chek is much lighter in weight than conventional check valves, yet is stronger. By dividing the opening, the unsupported plate area is reduced so that each plate requires only one-eighth of the weight of a conventional clapper of the same strength. The short stocky body is inherently stronger and more rigid than a short length of heavy wall pipe.

Whatever your check valve application, the Mission Duo-Chek can cut initial purchase and installation costs, cut maintenance costs from then on. Contact Mission now for a representative.

MISSION VALVE AND PUMP CO. A SUBSIDIARY OF MISSION MANUFACTURING CO. P. O. Box 4209, Houston, Texas • Cable Address 'MISSCO' • Export Office: 30 Rockefeller Plaza, New York • In the United Kingdom: MISSION MANUFACTURING CO., LTD., 1 Hanover Square, London W. 1 England • Cable Address 'MISSOMAN' • Sold by Mission Manufacturing Company outside of Canada and the U.S.A.

MISSION VALVE AND PUMP CO.



Look into Lonergan Uniline valves for low temperature processing

Get positive reclosure control; prevent freeze-up, down to −450°F!

If you process gases or liquids at extremely low temperatures, then it will pay you to try a Lonergan Uniline valve. Especially designed for cryogenic service, Lonergan Uniline valves provide:

1. Positive opening and closing action with maximum tightness provided by two-piece, self-aligning disc.
2. Precise blowdown control obtained by adjusting ported reaction disc opening.
3. Sharp pop action and reclosure without affecting lift and flow.
4. Maximum tightness from optically-flat discs and seats.
5. Choice of caps — plain, lifting lever or packed lifting lever.

If you are processing oxygen, nitrogen, hydrogen or exotic gases at low temperatures in either liquid or gas form, then Lonergan Uniline valves will provide maximum efficiency and control. Complete details on sizes, trim, materials and capacities are in Catalog 1000-V. Write for your copy today.

Lonergan

J. E. LONERGAN COMPANY, 203 RACE STREET
PHILADELPHIA 6, PENNA. • SINCE 1872

Check 5370 opposite last page.

Isometric-pipe drawings without tears

A template has been designed for isometric-pipe drawings. It permits standardized-isometric drawings to be made of all pipe-layout sketches.

The pocket-size template is made of laminated clear plastic. It includes cutouts for most fittings symbols, rounded corners for uniform angles and compass-orientation points.

(Isometric-pipe template may be obtained from Wally Verrett, Box 3144, Port Authur, Texas.)

Check 5371 opposite last page.

NEW LITERATURE

Plant Engineering, Safety and Fluids Handling

V-belt-drive design is taken up in 60-page catalog covering all phases of drive design, including belt selection and maintenance, drive selection by belt section, design, grooved-sheave data and belt tensioning. V-belt-drive Design Cat—Sales Division, Inc., Gates Rubber Company.

Check 5372 opposite last page.

Features of 600v switchgear with K-line circuit breakers are presented in 20-page bulletin. Information on low-voltage power circuit breakers and switchboard, in unit ratings of 225 to 4000 amp, are contained in Bul 3200-1A—I-T-E Circuit Breaker Company.

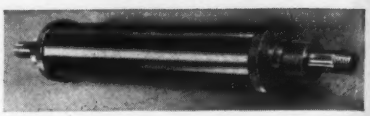
Check 5373 opposite last page.

Pressure-drop data on lubricated plug valves is compiled in 12-page booklet to enable systems designers to select most efficient and economical valve for their pipe needs. Pressure Drop Bul — Walworth Company.

Check 5374 opposite last page.

Reference tool for maintenance engineer is 118-page book which contains three indexes, more than 48 construction tables, guides and charts, along with outline of use, application and coverage of 100 construction and maintenance specialties. Copy of Construction Data Handbook may be obtained by writing on company letterhead to A. C. Horn Companies, division of Sun Chemical Corp., 550 3rd St., San Francisco, Calif.

SELAS MICRO-FILTERS provide compact, production-line methods for fine filtration



SELAS MICRO-FILTERS eliminate intricate set-ups requiring complicated apparatus and provide more-compact and efficient methods to handle the entire range of fine-filtration operations—from preliminary clarification to final sterilization.

Utilizing inert, micro-porous porcelain filter elements, SELAS MICRO-FILTERS provide distinct advancements in critical, fine-filtration techniques, which can increase production and lower costs . . . for pharmaceutical, bacteriological and biological groups, as well as for the fine-chemical and food industries.

Units can be readily installed in a metal or glass pipe, or rubber hose line, and easily removed from flow line without use of tools.

Bulletin MF-1 contains all the facts. For your copy, write:

SELAS *Flotronics*

Spring House, Pa.
A Division of Selas Corporation of America

Check 5375 opposite last page.

Insulating firebrick is taken up in 35-page bulletin containing complete discussion of advantages of insulating firebrick, as well as chartered information on variety of applications. Bul R-38—Refractories Division, The Babcock & Wilcox Company.

Check 5376 opposite last page.

Aluminum grating and steel grating and treads are cataloged, respectively, in Bul KG-2-11-60 and Bul KA-4-11-60 — Kerrigan Iron Works Company.

Check 5377 opposite last page.

Welding techniques for use with pressure pipeline and piping systems are explained in 20-page Bul 2112.2—Lincoln Electric Co.

Check 5378 opposite last page.

Pump motors and drives are cataloged in 20-page brochure which is indexed so that motors and drives may be identified as to construction type, enclosure, and U.S. pipe designation. Bul F-2002 — U.S. Electrical Motors, Inc.

Check 5379 opposite last page.

Ball valves are considered in 32-page catalog containing information on manually and pneumatically operated types in sizes of ¼ to 12". Dimensions and weights, material specifications, typical C_V values and pressure-temperature rating charts are provided in Cat 1200—Hills McCanna Company.

Check 5380 opposite last page.

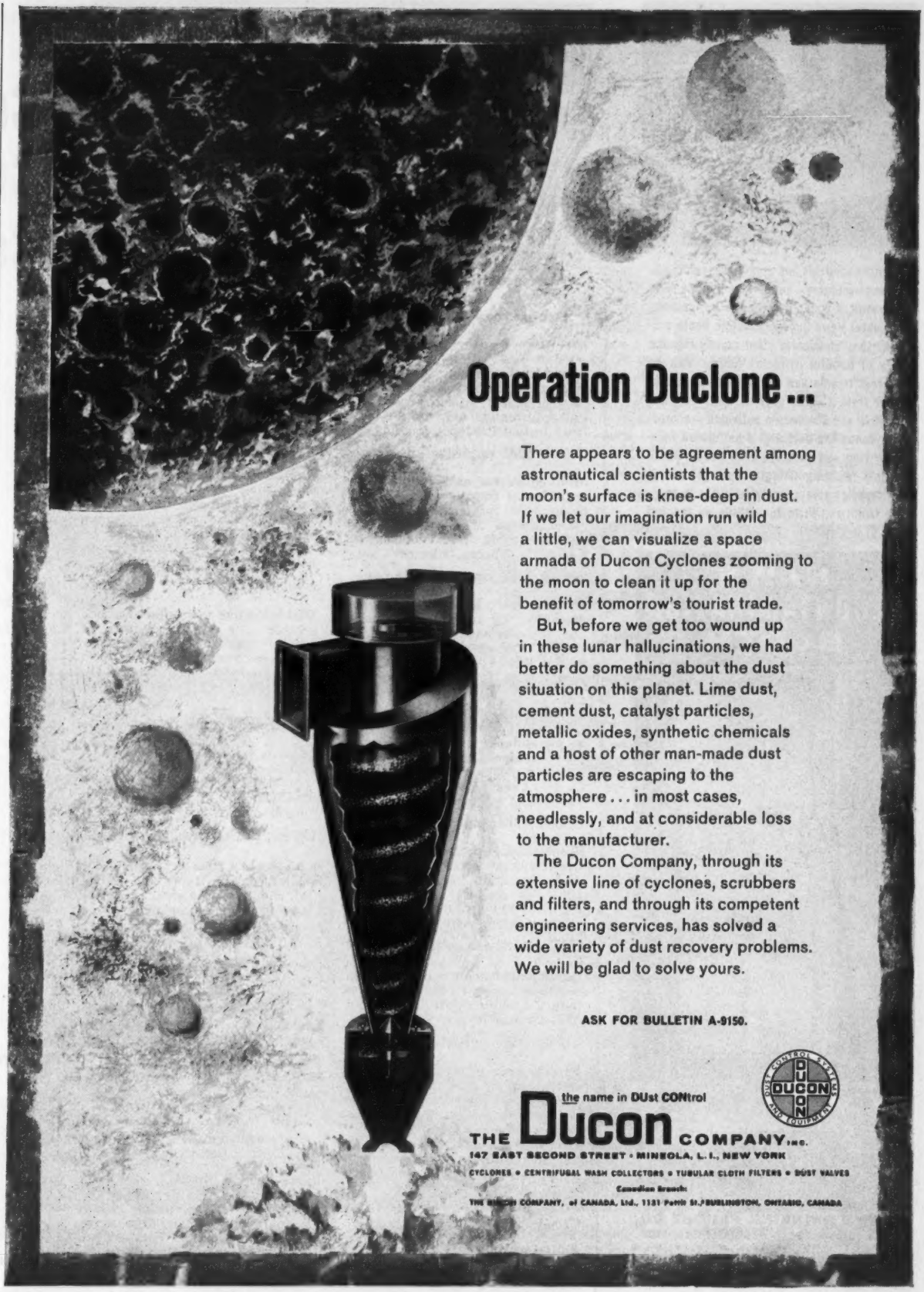
Sizing control valves for known conditions of flow, pressure, etc., is task of slide rule. Rule solves for C_V and corrects for steam quality, gas specific gravity and temperature, and liquids specific gravity and viscosity. Control-valve Sizing Slide Rule—Fulton Sylphon Division, Robertshaw-Fulton Controls Company.

Check 5381 opposite last page.

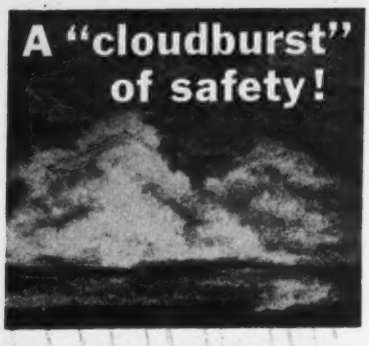
Rolling diaphragms are comprehensively presented in 24-page publication complete with descriptions, operation details, applications, installation suggestions and design data. Diaphragm Design Manual — Bellofram Corp.

Check 5382 opposite last page.

Refrigerant-pipe data is tabulated in 64-page booklet containing information in tabular and chart form not available elsewhere. "Refrigerant Piping Data" may be obtained by remitting $3.00 to Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., NW, Washington 6, D.C.

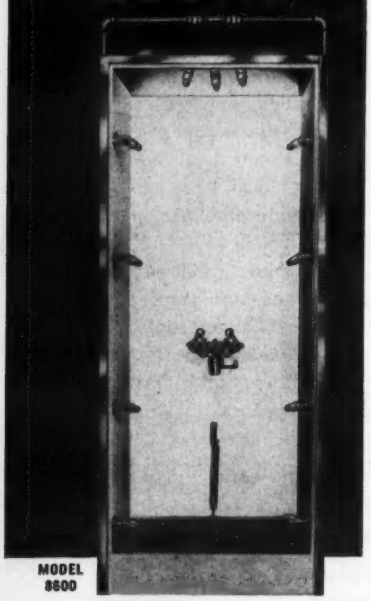

Operation Duclone...
There appears to be agreement among astronautical scientists that the moon's surface is knee-deep in dust. If we let our imagination run wild a little, we can visualize a space armada of Ducon Cyclones zooming to the moon to clean it up for the benefit of tomorrow's tourist trade.
But, before we get too wound up in these lunar hallucinations, we had better do something about the dust situation on this planet. Lime dust, cement dust, catalyst particles, metallic oxides, synthetic chemicals and a host of other man-made dust particles are escaping to the atmosphere . . . in most cases, needlessly, and at considerable loss to the manufacturer.
The Ducon Company, through its extensive line of cyclones, scrubbers and filters, and through its competent engineering services, has solved a wide variety of dust recovery problems. We will be glad to solve yours.
ASK FOR BULLETIN A-9150.
the name in DUst CONtrol
THE Ducon COMPANY, Inc.
147 EAST SECOND STREET • MINEOLA, L. I., NEW YORK
CYCLONES • CENTRIFUGAL WASH COLLECTORS • TUBULAR CLOTH FILTERS • DUST VALVES
Canadian Branch:
THE DUCON COMPANY, of CANADA, Ltd., 1121 Perth St., BURLINGTON, ONTARIO, CANADA

Check 5383 opposite last page.



Volatile chemicals and propellants can cause serious accidents—but serious injuries need not result if water irrigation is immediately available! Haws Decontamination Booth provides the "cloudburst" that rapidly rids the body of harmful irritants. Victims walk on the foot treadle and are instantly bathed in water from a dozen nozzles. Haws Eye-Face Wash is simultaneously activated—a pressure controlled unit with a perforated face-spray ring and twin eye-wash heads. Booth is acid resisting fiberglass plastic, and is delivered complete, ready for tie-in to existing facilities. Write for details on the full line of models.

HAWS DECONTAMINATION BOOTH



HAWS

HAWS DRINKING FAUCET CO.
1443 FOURTH STREET • BERKELEY 10, CALIF.
EXPORT DEPARTMENT: 19 Columbus Avenue
San Francisco 11, California, U.S.A.

Check 5384 opposite last page.

manufacturers' current literature

This section features a variety of literature currently available from manufacturers. See also the other sections in this issue for new literature pertaining to those particular sections

Process Instrumentation and Laboratory Apparatus

Liquid-level control incorporates magnetic proximity switch utilizing permanent Alnico-V magnet. Full information may be obtained from Jo-Bell Products, Inc.

Check 5385 opposite last page.

Multi-conductor cable permits installation of from 6 to 56 pairs of color-coded insulated thermocouple leads, all at one time, using just one cable. It is detailed in Cat 83-5—Thermo Electric Co.

Check 5386 opposite last page.

Shaft-motion indicators protect machinery by indicating stoppage due to overloading or malfunctioning. Full details are contained in Bul RG-21—Bin-Dicator Co.

Check 5387 opposite last page.

Density-gage, consisting of sealed source of nuclear energy mounted to one side of product carrier or pipe with radiation detector mounted opposite, is covered on Density Gage Data Sheet—Princeton Div., Curtiss-Wright Corp.

Check 5388 opposite last page.

Proportioning pumps have repetitive metering accuracy of −1% when operating between 10 and 100% of capacity. Proportioning Pumps — Pump Division, American Meter Company.

Check 5389 opposite last page.

Continuous reactor and mixing assemblies for pilot-plant applications are pictured in four-page Cat 287—Marco Development Co., Inc.

Check 5390 opposite last page.

Particle oven incorporates method embodying air-projection assembly which shoots high-velocity air into bed of material causing it to become completely aerated. All particles are in motion, but are in regular contact with conveyor in fluidized state. Particle Oven—Jetzone Laboratory Division, Wolverine Equipment Company.

Check 5391 opposite last page.

Sampling bombs are made of stainless steel. Alloy Products Corp.

Check 5392 opposite last page.

Process refractometer has accuracy of ±1%, full-scale, or ±0.000005% RI, whichever is larger. It is specified in Refractometer Tech Bul—Instrument Div., Mine Safety Appliances Co.

Check 5393 opposite last page.

Ultrasonic level-control systems are available in single-sensor (for liquid-level control) and double-sensor (for dry-level control) systems. Sonac Level Controls—Delavan Manufacturing Company.

Check 5394 opposite last page.

Continuous sampler for obtaining representative water samples over periods to 24 hours is specified on Aquator Data Sheet—Princeton Division, Curtiss-Wright Corp.

Check 5395 opposite last page.

Dial-indicating thermometers, each provide 270 angular degrees of evenly divided graduated arc. They are covered in Product Data Sheet 3—Industrial Instrument Division, The Electric Autolite Company.

Check 5396 opposite last page.

Mercury actuated recording thermometers have range of −40 to +1000°F or °C equivalent. They are taken up in Bul 45—Palmer Thermometers, Inc.

Check 5397 opposite last page.

Liquid-meter line is available in wide variety of types and metals, including stainless steel. Rockwell Manufacturing Company.

Check 5398 opposite last page.

Set-point controllers of tubeless solid-state digital type, each have control points which can be set in increments as small as ½° (depending on range). They are reviewed in Bul JY—West Instrument Corporation.

Check 5399 opposite last page.

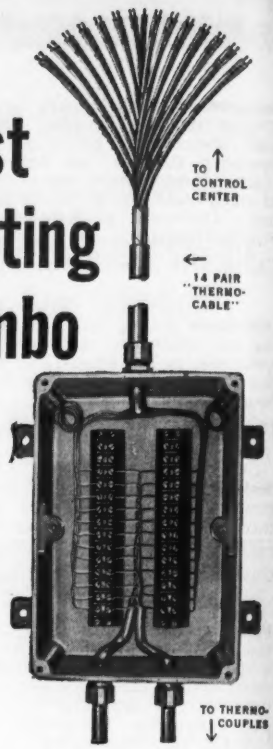
Thermocouple selector switches of rotary, key and pushbutton types, are tabulated in Cat 24-5—Thermo Electric Co., Inc.

Check 5400 opposite last page.

Recording thermometers have standard-chart temperature ranges of −80 to ±650°F. They are presented on Product Data Sheet 4—Industrial Instrument Division, The Electric Autolite Company.

Check 5401 opposite last page.

Cost Cutting Combo



for Thermocouple Extension Wire Installations

Here's an economy team to increase efficiency and cut costs up to 75% in your next thermocouple extension wire installation. Multi-conductor THERMO-CABLE* permits you to install from 6 to 56 pairs of color-coded, insulated thermocouple leads, at one time, using just one cable. Terminate the wires in a weatherproof multi-terminal box specifically designed for THERMO-CABLE.

No more pulling individual leads through conduit. And, THERMO-CABLE, with its polyvinyl chloride weatherproof, heat and corrosion resisting outer sheath often eliminates the need for conduit. Direct burial types available to eliminate hazards from fire and mechanical damage.

T.E. weatherproof Terminal Boxes are made of cast iron or sheet steel, can accommodate from 6 to 100 circuits, and offer sure protection against the effects of contaminating atmospheres. Made to N.E.M.A. or JIC specifications.

Write today for Catalog 83-5

*Trade Mark

Thermo Electric CO., INC
SADDLE BROOK, NEW JERSEY

In Canada: THERMO ELECTRIC (Canada) LTD., Brampton, Ont.

Check 5402 opposite last page.

Digital control computer is capable of 25,000 additions/sec. It incorporates core memory with drum-memory backup plus more than 100 basic commands to provide programming flexibility. Digital Control Computer 412—Process Computer Section, Industry Control Dept., General Electric Company.

Check 5406 opposite last page.

Liquid-level gages available in reflex types for pressures to 4000 psi at 100°F and transparent versions for pressures to 20,000 psi, test. They are considered in Cat 316—Jerguson Gage & Valve Company.

Check 5407 opposite last page.

Processing Equipment

Vacuum pans, in capacities of 10- to 500-gal, and quick-cooling pans, in capacities of 50- to 200-gal, are specified in two bulletins available from Lee Metal Products Company, Inc.

Check 5408 opposite last page.

Processing equipment, such as debutinizers, exchangers, fractionating towers, pressure vessels and other equipment, is built to order by Sun Shipbuilding & Dry Dock Company.

Check 5409 opposite last page.

Continuous reactor permits handling of those reactions which evolve considerable quantities of heat, as well as those end products which are extremely viscous or result in product which fouls conventional heat-exchange surface. Full story is contained in Bul V250-11H—Girdler Process Equipment Division, Chemetron Corp.

Check 5410 opposite last page.

Kettles of various types are considered in six bulletins. Two-thirds-jacketed, 80- to 300-gal; 2/3-jacketed, 5- to 500-gal; 2/3-jacketed, 5- to 100-gal; 2/3 jacketed, 40- to 200-gal; full jacketed, 10- to 300-gal; and center-line scraper-agitator, 80- to 300-gal types are subjects of CW, A, C, Pressure, B, and CW3T Kettle Buls—Lee Metal Products Co.

Check 5411 opposite last page.

Ion-exchange equipment, for applications such as purification of citric acid, lactic acid, and tartaric acid by cation and anion exchange, is manufactured by Illinois Water Treatment Co.

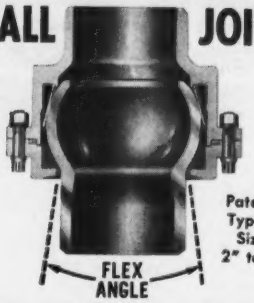
Check 5412 opposite last page.

For more information on developments in the section, check the Reader Service Slip.

BARCO

High Temperature (from 500° to 1200°F)

BALL JOINTS



Patented Type HT Sizes: 2" to 16"

NEW! A simple way to solve

PIPE EXPANSION PROBLEMS

Send for New Catalog No. 250

BARCO

At risers . . . at offsets . . . in straight runs, install Barco Flexible Ball Joints to handle any amount of PIPE EXPANSION—also twisting, torsional movement. Here's why it PAYS:

Save Time—Expensive engineering and stress analysis not required.

Cut Costs—No "pressure end thrust" in Barco joints; heavy anchoring and pipe guides not needed for installation.

Safety—Joints are *self-aligning* for protection against costly "mis-alignment" damage. No thin wall sections; no lubrication needed.

Save Space—One foot of offset (between ball center points) provides for 3" expansion. *Find out about this method; send for literature.* BARCO MANUFACTURING CO., 537 J Hough St., Barrington, Illinois.

Check 5403 opposite last page.

PISTON PACKING PROBLEMS SIMPLIFIED!

Conventional and 45° bevel type Pumcups.

● The *right* piston packing for reciprocating pumps and cylinders goes a long way toward eliminating the problems of slippage, maintenance and down-time.

Because Darcova Pumcups are made in a complete range of sizes, various types, and in many texture-engineered compositions, they *fit* your temperature-pressure-fluid conditions. That's one important reason why they usually outlast other packing at least 3 to 1 while holding top efficiency to the last!

Pumcups are available in 100% Nylon as well as other texture-engineered compositions. Send today for Bulletin 5903.

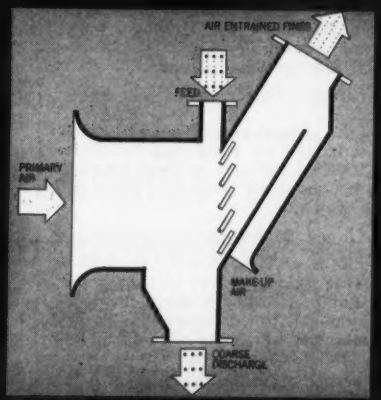
DARLING VALVE & MANUFACTURING CO.
Williamsport 4, Pa.

DARCOVA

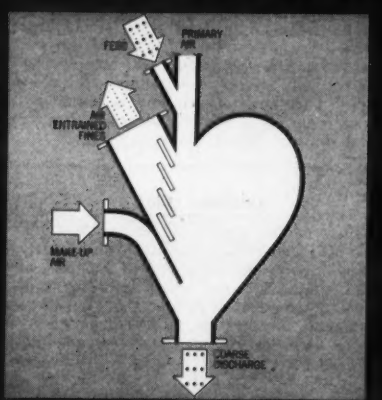
TRADE MARK PUMCUPS

Check 5404 opposite last page.

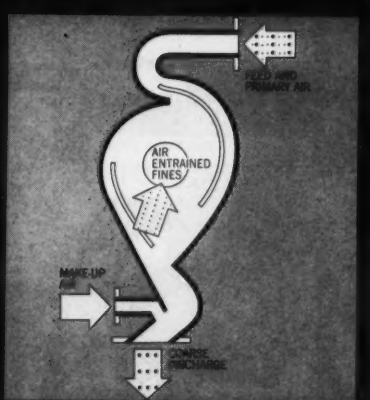
More and More Products are now sized with BUELL CLASSIFIERS



Gravitational Classifier—Replaces screens and sieves in the 20 to 65 mesh range with comparable or better efficiency. Low maintenance, instant control of cut point and limited space requirements.



Gravitational-Inertial Classifier—Extremely high efficiencies for separation in 65-200 mesh range. Pneumatic conveying and elevating of feed and fines, no moving parts, single damper to control cut points.



Centrifugal Classifier—Unmatched performance in the 200 mesh to 20 microns size range. No moving parts, easy adjustment of cut points, and pneumatic conveying and elevating of feed and fines.

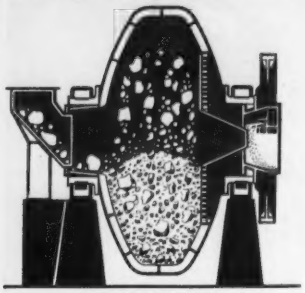
Classifiers can be operated in series to obtain several closely sized fractions in one continuous operation.

Write: Buell Engineering Co., Dept. 11-H, 123 William St., New York 38, N. Y. Other Products: Electric Precipitators • Cyclones • Bag Collectors • Combination Systems

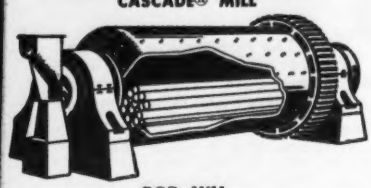
buell Norblo

Check 5405 opposite last page.

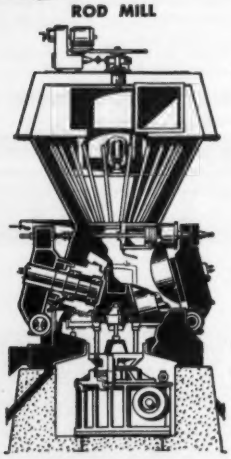
GRINDING AND PULVERIZING



CASCADE® MILL



ROD MILL



DISC-ROLL MILL

TUBE MILL

CONICAL AND TRICONE MILLS

No matter what your grinding problem—coarse or fine grind—ball, pebble or autogenous — Hardinge has a mill for the job.

CASCADE® MILL

A continuous mill using the autogenous grinding principle—large pieces of material grinding the smaller ones. Shape of the mill causes maximum "free fall" and impact. Feed is divided into coarse and fine components and re-combined in proper proportion for best grinding.

ROD MILL

Steel rods are employed as grinding media. Ideal for producing minimum oversize in open circuit grinding. Conical heads prevent "choking" of the charge at the ends, and align the rods. Available with either end, or center, peripheral discharge, as well as trunnion overflow.

DISC-ROLL MILL

A roller-mill with rotating grinding table and spring-loaded rolls. The "Gyrotor" Classifier, combined with the Disc-Roll Mill, provides a highly-efficient dry-grinding device, ideal for relatively soft minerals.

TUBE MILL

For a fine product in open circuit without the use of classifiers. For mixing and grinding to secure a smooth texture or plastic product. Often used as an autogenous grinding mill.

CONICAL MILL®

The shape of the Hardinge Conical Mill causes a rapid circulating and classifying action within the drum, which increases the capacity for power expended over other types. The range of grinding is large, due to segregation of media and material within the mill.

TRICONE* MILL

Built on the same principle as the Conical Mill, the Tricone Mill offers greater grinding volume for a given amount of floor space than any other tumbling mill built. Extremely efficient. Ideal for large tonnages. Sizes up to 12 ft. diameter.

* Trademark

Consult your nearest Hardinge office, giving them full details of your grinding problem.

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TORONTO
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SALT LAKE CITY
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LAKELAND
BIRMINGHAM

Check 5413 opposite last page.

CURRENT LITERATURE

Vertical mixers, each feature internal centrally positioned material lifting screw. Turbo-type dispensing blades distribute particles at top with subsequent gravity flow to bottom. Specifications are covered in Bul TB-701—Goslin-Birmingham Manufacturing Co., Inc.

Check 5414 opposite last page.

Pulp and storage tanks, in capacities of 500- to 2000-gal and 100- to 5000-gal, respectively, are subjects of two bulletins published by Lee Metal Products Company, Inc.

Check 5415 opposite last page.

Separation and Size Reduction

Micro-filters handle entire range of fine-filtration operations, from preliminary clarification to final sterilization. They are indexed in Bul MF-1—Selas Flotronics, Division of Selas Corporation of America.

Check 5416 opposite last page.

Rubber cutting is subject of bulletin now available from Taylor, Stiles & Company.

Check 5417 opposite last page.

Dust- and fume-control equipment is detailed in Bul 562-D—Wheelabrator Corporation.

Check 5418 opposite last page.

Controlled-dispersion mixing of dry or wetted solids is considered in Handbook on Mulling—Simpson Mix-Muller Division, National Engineering Company.

Check 5419 opposite last page.

Disc separators and graders which separated by width and by thickness are subjects of three descriptive booklets available from Simon-Carter Co.

Check 5420 opposite last page.

Fine grinding into micron range and precise end-product classification—all in one operation—is job of units which are covered in Bul 093—Sturtevant Mill Company.

Check 5421 opposite last page.

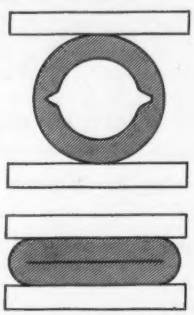
Sanitary screeners separate wet or dry materials and are quickly cleanable and dust-tight. Rotex Sanitary Screeners—The Orville Simpson Co.

Check 5422 opposite last page.

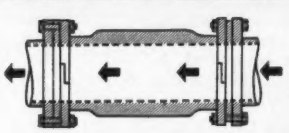
For more information on developments reported in this section, check corresponding numbers on Reader Service Slip opposite last page of this issue.

Massco-Grigsby PINCH VALVES

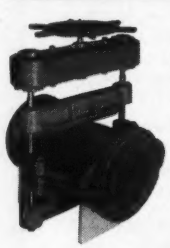
"Hinged" sleeve permits tight closing reduces wear.



Recesses in sleeve serve as "hinges" during compression.



Unobstructed flow eliminates high friction loss; and there are no metal parts in contact with pulp or liquid.



Several types of closing mechanisms are available, from handwheel to motorized.

Automated Systems. Completely automatic systems may be coordinated and interlocked with other plant equipment.

1" to 14" I.D.; pressures to 150 psi; temperatures to 200° F.

WRITE FOR CATALOG 609

MINE AND SMELTER SUPPLY CO.

3800 RACE STREET • DENVER, COLORADO
OFFICES AND AGENTS IN PRINCIPAL CITIES

Check 5423 opposite last page.

CURRENT LITERATURE

Decanters' handling capabilities range from slurries having solids content of 0.05 to 50%, as well as solids from ¼" down to a few microns in size. For more information see Super-D-Canters Information—The Sharples Corporation.

Check 5424 opposite last page.

Rotating-leaf pressure filters were designed specifically for removing color and purifying corn syrup. Complete filter element is all-stainless-steel Type-316 construction in filters which are covered in information available from Goslin-Birmingham Manufacturing Co., Inc.

Check 5425 opposite last page.

Chemical Materials

Tetrahydrofuran is discussed in 14-page bulletin covering properties, uses as resin solvent, solvent in chemical operations, chemical intermediate . . . and other uses such as paint remover and coal cleaner. Tetrahydrofuran Bul—Electrochemicals Department, E.I. du Pont de Nemours & Company, Inc.

Check 5426 opposite last page.

Hexachlorocyclopentadiene derivatives now include acids, acid halides, acid anhydrides, esters, amides, ketones, diketones, quinones, acetals, nitriles and list of other halogenated hydrocarbons. Properties and other information on this material are tabulated in Bul 65—Hooker Chemical Co.

Check 5427 opposite last page.

Mineral acids, including sulfuric, muriatic, phosphoric, nitric, hydrofluoric and mixed-nitric-and-sulfuric acids are subject of Mineral Acids Information—General Chemical Division, Allied Chemical Corporation.

Check 5428 opposite last page.

Carbon dioxide and its applications are taken up in information published by Chemicals Division, Olin Mathieson.

Check 5429 opposite last page.

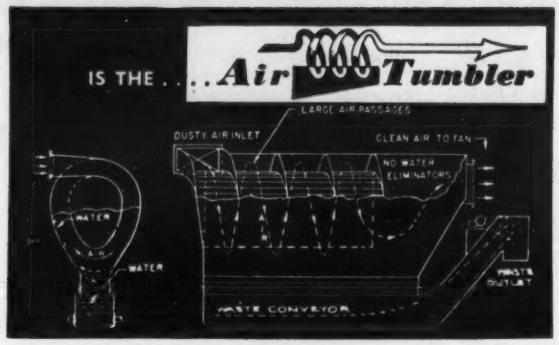
Silicone defoamers are reviewed in Foam Control Manual—Dow Corning Corporation.

Check 5430 opposite last page.

Sodium-cyanide properties and handling procedures are treated in eight-page bulletin giving in detail a method of disposing of cyanide wastes. Sodium Cyanide Bul—Sodium Products Division, Electrochemicals Department, E.I. du Pont de Nemours & Co., Inc.

Check 5431 opposite last page.

The MASTER of DUST in INDUSTRY



THE WET COLLECTOR THAT BECOMES STANDARD EQUIPMENT WHEREVER TRIED BECAUSE IT DOES A BETTER JOB AT LESS COST.

More than one million CFM in ONE plant

Write for Bulletin No. 601 Address

DUST SUPPRESSION & ENGINEERING CO.
P. O. BOX 67 • LAKE ORION, MICHIGAN

Check 5432 opposite last page.

HI-TEMPERATURE LO-PRESSURE

liquid phase heat transfer systems

if
—Your product temperature requirements are high
—You want to avoid high pressure equipment
—You need close temperature control and safe, automatic operation at reasonable cost . . .

. . . . You should consider a space saving, all electric, Merrill Process System

Write for Bulletin 597 giving details of the Pilot Plant Series or send us your requirements.

Parks-Cramer Company
FITCHBURG , MASS.

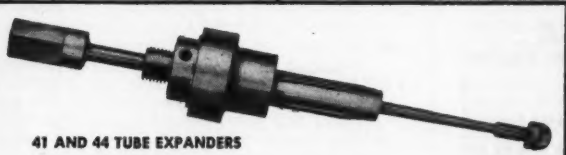
Check 5433 opposite last page.

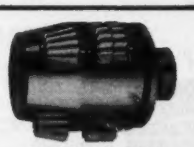
BETTER TOOLS FOR BETTER WORK

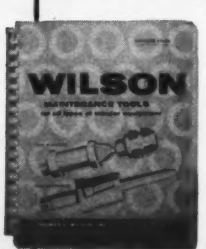
Wilsonize to economize—the buy-words in tube maintenance

EP REFINERY TYPE TUBE CLEANERS

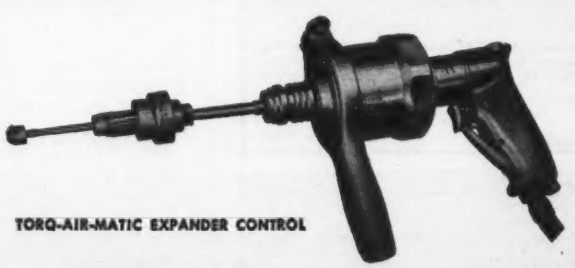
HEAVY-DUTY HEAT EXCHANGER CLEANER


41 AND 44 TUBE EXPANDERS


R CUTTER HEADS



Wilson has hundreds more to meet every tube maintenance need. Send for comprehensive catalog 77-88.


TORQ-AIR-MATIC EXPANDER CONTROL

TW-914

THOMAS C. WILSON, INC. 21-11 44TH AVE., LONG ISLAND CITY 1, NEW YORK
Representatives in principal cities • Cable address "Tubeclean" New York

Check 5434 opposite last page.

Bear Down on FOAM

with Dow Corning Silicone Defoamers*

There's a *right* tool for every job. In foam control it's Dow Corning silicone antifoamers or defoamers . . . job-proved thousands of times over as the most efficient, most economical, and most versatile foam suppressors available.

*At prescribed levels, are sanctioned by FDA

FREE SAMPLE
and new manual on foam control

first in silicones **Dow Corning CORPORATION**
MIDLAND, MICHIGAN

Dept. 2720a

Please rush a FREE SAMPLE of a Dow Corning silicone defoamer for my product or process, which is (indicate if food, aqueous, oil or other): _____

NAME _____

POSITION _____

COMPANY _____

ADDRESS _____

_____

Check 5435 opposite last page.

CURRENT LITERATURE

Hydrofluoric-acid information and prices are available from General Chemical Division, Allied Chemical Corporation.

Check 5436 opposite last page.

Benzyl chloride is insoluble in water but miscible with both alcohol and ether. Properties and other facts on the material are contained in Benzyl Chloride Data Sheet—Hooker Chemical Corporation.

Check 5437 opposite last page.

2-Nitropropane has unique solvent property permitting use of larger proportions of low-cost alcohols and aromatics in solubilizing variety of coating materials, dyes, organic chemicals, fats and oils. Data on 2-NP for vinyl and epoxy coatings may be obtained from Nitroparaffins Department, Commercial Solvents Corporation.

Check 5438 opposite last page.

Fluorides are the subject of technical information published by General Chemical Division, Allied Chemical Corporation.

Check 5439 opposite last page.

Sodium handling and properties are tabulated in 16-page bulletin covering properties, specifications, characteristics and uses, among other things. Sodium Bul—Electrochemicals Department, E.I. du Pont de Nemours & Company, Inc.

Check 5440 opposite last page.

Nialk trichlorethylene is pure solvent distilling between 86.6 and 87.4°C. It has no acidity and alkalinity as NaOH is 0.008% max. Complete information is contained in Nialk Trichlorethylene Data Sheet—Hooker Chemical Corporation.

Check 5441 opposite last page.

"It's next door; he wants to buy us out."

Mineral products, such as silicas, tamart, red oxides and calcium carbonates are subject of specifications put out by Tamms Industries Co.

Check 5442 opposite last page.

Perlites are available in various grades to meet specific insulation requirements. Ryolex Industrial Perlites—Silbrico Corporation.

Check 5443 opposite last page.

Industrial-chemicals index covers products of Industrial and Biochemicals Department, E.I. du Pont de Nemours & Company, Inc.

Check 5444 opposite last page.

Hydrogen peroxide is available in drum quantities on 24-hr-delivery basis from Becco Chemical Division, Food Machinery and Chemical Corporation.

Check 5445 opposite last page.

Drying and Heating

Water-tube boiler with completely automatic control built-in is depicted in 12-page bulletin, covering nine successful installations. Bul 586A—Vapor Heating Corporation.

Check 5446 opposite last page.

Kiln installations and heat recovery systems are treated in Buls 1115 and TKB-3, respectively—Traylor Engineering & Manufacturing, Division of Fuller Company, Subsidiary of General American Tranportation Corporation.

Check 5447 opposite last page.

Heat-exchanger coil of plate type is available in wide range of standard sizes or specially formed or fabricated units, in most weldable metals. Operating pressures are to 250 psig for coil which is covered in Bul P54—Platecoil Division, Tranter Manufacturing, Incorporated.

Check 5448 opposite last page.

Ovens and dryers are available in batch and conveyor types for service to 1000°F. They are considered in Bul 157—Young Brothers Co.

Check 5449 opposite last page.

Flash-drying systems incorporates cage mill which disintegrates material to normal particle size and simultaneously reduces the moisture to a specified final content. Further details may be obtained from Raymond Division, Combustion Engineering Corp.

Check 5450 opposite last page.

Can you use

NON-SWELLING ABSORPTIVE

Montmorillonite

$Al_2O_3 \cdot 4SiO_2 \cdot H_2O$

PIKES PEAK® CLAY

Approximate chemical analysis

Loss @ 105°C.	0.60%
Further Loss on Ignition	3.25%
Silica (SiO_2)	73.77%
Alumina (Al_2O_3)	12.66%
Ferric Oxide (Fe_2O_3)	4.16%
Magnesia (MgO)	3.80%
Calcium Oxide (CaO)	0.34%
Ferrous Oxide (FeO)	0.08%
Sodium Oxide (Na_2O)	0.04%
Potassium Oxide (K_2O)	0.09%
Titanium Dioxide (TiO_2)	0.79%
Arsenic Oxide (As_2O_3)	0.00056%
Mercuric Oxide (HgO)	Less than 0.00005%*
Lead Dioxide (PbO_2)	Less than 0.00007%* Less as lead dioxide
Phosphorus Pentoxide (P_2O_5)	0.22%
Sulfate (SO_4)	0.17%
pH around 5	

*None found.

Currently used as:

- **Carrier** (liquids & solids)
- **Diluent** • **Extender**
- **Coagulant Aid**
- **Parting Agent**
- **Coating Agent**
- **Bleaching of chemicals, animal, mineral & vegetable oils**
- **Filter Agent**
- **Absorbent for liquids, chemicals, greases, oils**

PHYSICAL PROPERTIES — Like all mined products of this nature, physical properties of Montmorillonite will change in various degrees, determined by mesh size and quantity.

WRITE FOR SAMPLES — Write immediately for necessary samples, mesh sizes available and other technical data for further exploration into advantages of Montmorillonite in suiting your specific needs.

G R C **GENERAL REDUCTION COMPANY**
212 W. MONROE STREET
CHICAGO 6, ILLINOIS

Check 5451 opposite last page.

CURRENT LITERATURE

Vacuum dryers are jacketed conical-shaped units into which hot water, steam or vapor may be introduced as heat-transfer medium. They are available in sizes of 12" to 12' in diam. Conaform Vacuum Dryers—Patterson Foundry & Machine Company.

Check 5452 opposite last page.

Water-tube boilers, vapor-steam superheaters and liquid-phase heaters are topics considered in information published by Vapor Heating Corporation.

Check 5453 opposite last page.

Truck tray dryers can be designed for any number of trucks. Style of trucks and trays (or both) is determined by nature of material and other conditions. Truck Tray Dryers—National Drying Machinery Company.

Check 5454 opposite last page.

Liquid-phase heater which modulates automatically is treated in four-page bulletin containing full page of specifications and detailed schematic diagrams. Bul 4023—Vapor Heating Corporation.

Check 5455 opposite last page.

Corrosion Control

Deaerators for removal of oxygen down to 0.005 cc/liter and type which uses spray-content vent-condensing method to stop steam-vapor loss, are covered in Zero-oxygen and 0.03-inches Deaerators Cats, respectively—Fred H. Schaub Engineering Company.

Check 5456 opposite last page.

Corrosion inhibitor acts to separate moisture from metal surface and seals surface against re-entry of moisture and corrosive atmospheres. It is specified in CRC 3-36 Information—Corrosion Reaction Consultants, Subsidiary of Chas. J. Webb Sons Co., Inc.

Check 5457 opposite last page.

Sealless plastic pumps have capacity range to 40 gpm, temperature range of −60 to +350°F, and are available in 54 combinations of materials. They are featured in Cat 10—Vanton Pump and Equipment Corp., Division of Cooper Alloy Corporation.

Check 5458 opposite last page.

Penton's role in corrosion resistance and complete listing of Penton tank liners and producers of other types of Penton processing equipment are subjects of booklets, "The ABC's of Penton for Corrosion Resistance" and "The Penton Buyer's Guide"—Cellulose Products Department, Hercules Powder Company, Inc.

Check 5459 opposite last page.

ONE OF A SERIES OF CHATS ABOUT THE CONSERVATION AND CONTROL OF HEAT

SARCO TOPICS

DOWNTIME DOWN —OUTPUT UP

Continuous processing . . . two big words in the world of chemicals . . . and one big headache when the processing has to stop unexpectedly. It's not just the pure pain in the neck that mechanical failure produces. It's the production costs that keep mounting during down-time.

Let's face it, no one can eliminate every bug. But steam trap failure is a bug there's no excuse for. Not since Sarco created the Thermo-Dynamic Steam Trap, Type TD-50.

For example, Reichhold Chemicals know how bugless it is. They have standardized on this unique steam trap in their new Maleic Anhydride plant at Elizabeth, New Jersey. Of their 320 TD-50's, most are in service on 35-lb. steam tracer lines.

Results? Results!

For one thing, Reichhold has learned that TD-50's hardly know the meaning of the word downtime. Then, too, maintenance people like them for their ease of inspection and service. And TD-50's don't require high quality steam to function.

The character pretending to inspect one of Reichhold's TD-50's is Sarco's ad manager, who normally wears a gray flannel suit. We're happy to see strainers used properly on this 14-trap manifold to protect the steam traps, even if they don't happen to be Sarco strainers.

We don't want to sound like an advertisement, but it's this way: the TD-50 is so simply designed it has only one moving part; its performance is uniform; it operates equally well on heavy, light, or no condensate load — even against back pressures up to 50% of inlet pressures; it's so rugged that superheat, water hammer, vibration, or corrosive condensate won't affect it; if you should ever want to service a TD-50, a highly unlikely prospect, you can unscrew the cap, clean it, blow it down, and have it back on stream in 40 seconds.

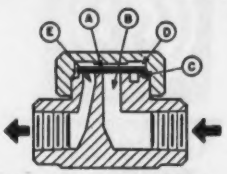
MR. BERNOULLI HELPS BUILD A BETTER STEAM TRAP

We may be a trifle tardy in bringing it up, but Daniel Bernoulli, who dreamed up the "Bernoulli Effect" about 250 years ago, deserves some sort of accolade from us here at Sarco. A plaque perhaps, or his name in the foyer floor tile. Daniel was a famous Swiss mathematical genius and he was probably a little hesitant about even mentioning his slightly offbeat discovery, the "Effect," in *Hydrodynamica* (1738).

If you happen to have a spool handy, you can perform the simple "effect" right at your desk. Lay a cardboard disc with a pin through it on the table. Place the spool over the pin and blow—hard—and lift. The disc won't fall until you stop blowing because the air under pressure expands between the end of the spool and the disc. The pressure in this space is actually less than atmospheric, and the sum of the downward forces is less than the upward force of atmospheric pressure acting upon the disc's bottom side.

Well, of course it *sounds* rather remote, but what seemed like a simple parlor trick to Bernoulli has made it possible for us at Sarco to solve steam trapping problems by the dozens. In our Sarco Thermo-Dynamic Steam Trap, Type TD-50, the cardboard disc is replaced by a stainless steel disc A, the spool tube by inlet tube B. The disc also acts as a valve and can seat on B, and also on outer seat ring C. When seated, the disc seals the inlet and the chamber D from the outlet E.

Full attention now, because it could easily be *your* steam, condensate, or air we're following here as it enters the trap, its pressure raising the disc and allowing fluid to flow radially across the underside of the disc. The velocity of air or condensate is comparatively low, exerting little influence on the disc, which remains



clear of the seat, allowing free discharge. Ah, but now steam enters the trap. Velocity increases greatly because of the steam's greater internal energy. Presto! The disc is pulled toward the seat just as was the cardboard. At the same time, the radial steam jet raises the pressure in D by recompression, snapping the disc down on the seat.

Downward force of recompressed steam in D, acting on the full area of the disc, is greater than the upward force of the inlet steam acting on the smaller area of the inlet orifice. So the disc remains seated, stopping all flow of steam, until pressure in D is reduced by condensation, and the cycle is repeated.

BEYOND THE TD-50 PRINCIPLE

Surprise! In spite of the one-track subject matter you've had the decency to ingest so far, we manufacture a good deal more than TD-50's. As a matter of proud fact, we are the only company that makes and sells all five types of steam traps. After all, there is a place for Balanced Pressure Thermostatic, Float Thermostatic, Camlift Bucket, and Liquid Expansion Thermostatic Steam Traps too. And our knowledgeable engineers can tell you exactly where to use what—and how.

And may we modestly add, that's only the beginning? As long as our present conversation seems to consist of product name dropping, we'll just mention the fact that we make exceptionally fine pressure and temperature regulators of rather astonishing variety and ingenuity. For example, we have a complete line of self-powered regulators for heating and cooling. And to make most effective use of these last few lines—strainers of all kinds—even hand and motor operated scraper strainer types. We could fill this page with lists of applications, testimonials, and specifications, but it would be eminently more sensible simply to say: Tell us your problem.

Write us direct, or contact your local Sarco sales representative or sales office.

Pardon our monopolizing the conversation in this series of paid communiques, but we're trying our best to interest you in certain subjects that concern us both—to the point where you'll communicate. 5902

SARCO

SARCO COMPANY, INC.
635 MADISON AVENUE, NEW YORK 22, N. Y.
PLANT: BETHLEHEM, PA.
STEAM TRAPS • TEMPERATURE CONTROLLERS
STRAINERS • HEATING SPECIALTIES

Check 5460 opposite last page.

TUR-BLEND

IMPORTANT NEW DESIGN IN MIXERS

SIMPLE, HIGHLY EFFICIENT DESIGN BY G-B

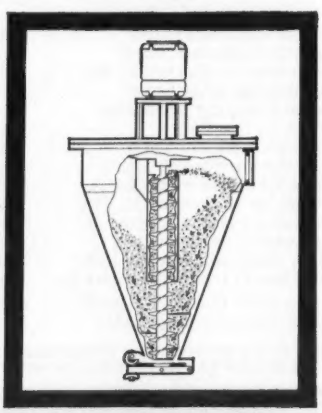
Tur-Blend is a new and important design in mixers, combining many desired features in one mixer.

- STATIONARY... no safe guards required
- COMPACT... hardly bigger than the mixing load
- SIMPLE... minimum of moving parts
- FLEXIBLE... may be jacketed or enclosed
- CAPACITIES... Sizes 24" to 96" dia., 2 to 185 cubic feet.

THIS IS HOW IT WORKS

The new vertical Tur-Blend features an internal, centrally positioned material lifting screw. It's turbo-type dispensing blades briskly distribute particles at the top, with subsequent gravity flow to the bottom. The unit is equipped with quick discharge bottom outlet.

Ask for bulletin #TB-701



GOSLIN-BIRMINGHAM
MANUFACTURING CO., INC.
P.O. BOX 631 • BIRMINGHAM, ALABAMA

FILTERS / EVAPORATORS / PROCESS EQUIPMENT
CONTRACT MANUFACTURING
including HEAVY CASTINGS

Check 5461 opposite last page.

CURRENT LITERATURE

Thin-wall-pipe fittings of corrosion-resistant metals incorporate extra length of straight on every end of every fitting. Speedline Fittings—Horace T. Potts Company.

Check 5462 opposite last page.

Aluminum-bronze-alloy pipe for corrosive applications gives Brinell hardnesses of 150 and tensiles to 70,000 psi. Information on these may be obtained from Ampco Metal, Inc.

Check 5463 opposite last page.

Coating for corrosion protection of brick, steel and concrete chimneys against acid corrosion from high-sulfur fuels is explained in six-page Stackfas Brochure—Benjamin Foster Company, Division of Amchem Products Inc.

Check 5464 opposite last page.

Meters for handling and control of corrosive and standard liquids are indexed in Bul 48—Buffalo Meter Company, Inc., Subsidiary of American Meter Company.

Check 5465 opposite last page.

High-temperature finish is unaffected by temperatures in range of 400 to 600°F. Sicon Finish—Midland Industrial Finishes Co.

Check 5466 opposite last page.

Valves

Check valves; cause, effect and control of water hammer; and pressure-lost tests are subjects of Buls 654, 851 and 659, respectively—Williams Gauge Co., Inc.

Check 5467 opposite last page.

Ball valves each incorporate body which can be removed in 13 seconds without disturbing any other part of pipe. Clayton Mark & Company.

Check 5468 opposite last page.

Line blind valves of non-contaminating visible shut-off type are detailed in Hamer Cat 60—Well Equipment Mfg. Corp.

Check 5469 opposite last page.

Check-valve literature describes quick installation of valves and tells how two- and three-inch models are applicable to series 150, 300 and 600 flanges—Mission Valve & Pump Co.

Check 5470 opposite last page.

Small steel valves, including 600-psi gate, globe, angle and check valves in ¼ to 2", are available in forged and cast steel with Exelloy, Stellite, Type-316 stainless and Monel trims. Industrial Products Group, Crane Co.

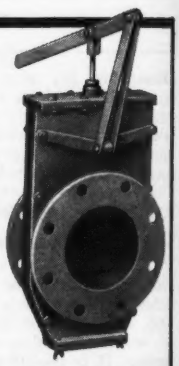
Check 5471 opposite last page.

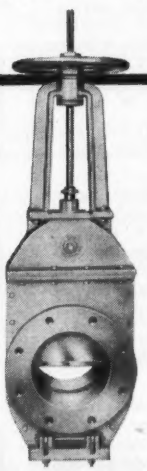
ROCKWELL SLIDE VALVES

for GASES SLURRIES OR FREE-FLOWING SOLIDS THAT CLOG OR JAM OTHER VALVES...

Standard Slide Valve, screwed end type or flanged (shown); when fully open, valve offers no restriction to fluid flow. Bulletin 500R.

"Kwikleen" Slide Valve—Not necessary to remove from line for cleaning. Sediment discharged at bottom. Complete cleanout by attaching steam, water or air line to plug hole in valve body. Bulletin 501R.





Heavy Duty "Kwikleen" Valve for line pressures to 60 psi. Blade not exposed when in fully open position. Ideal for pulp stock, slurries, dust, fly ash, scale, granular materials. Bulletin 508.

W. S. ROCKWELL CO.
2200 Eliot St., Fairfield, Conn.

Check 5472 opposite last page.

Globe valves, each incorporate non-rotating stem and non-rising hand wheel with disc assembly pinned to stem. Line is taken up in Bul 7—Alloy Steel Products Company.

Check 5473 opposite last page.

Resilient-seated butterfly valves are self-cleaning and each have snap-in-type renewable liners. Additional data is contained in Bul 590—W.S. Rockwell Company.

Check 5474 opposite last page.

Ball valves are delineated in 72-page catalog which incorporates seven pages of detailed metal specifications. Cat BV-60—Pacific Valves, Inc.

Check 5475 opposite last page.

Ball-valve design is particularly applicable to handling fluids below −150°C. Complete line is taken up in Ball Valve Literature —Jamesbury Corp.

Check 5476 opposite last page.

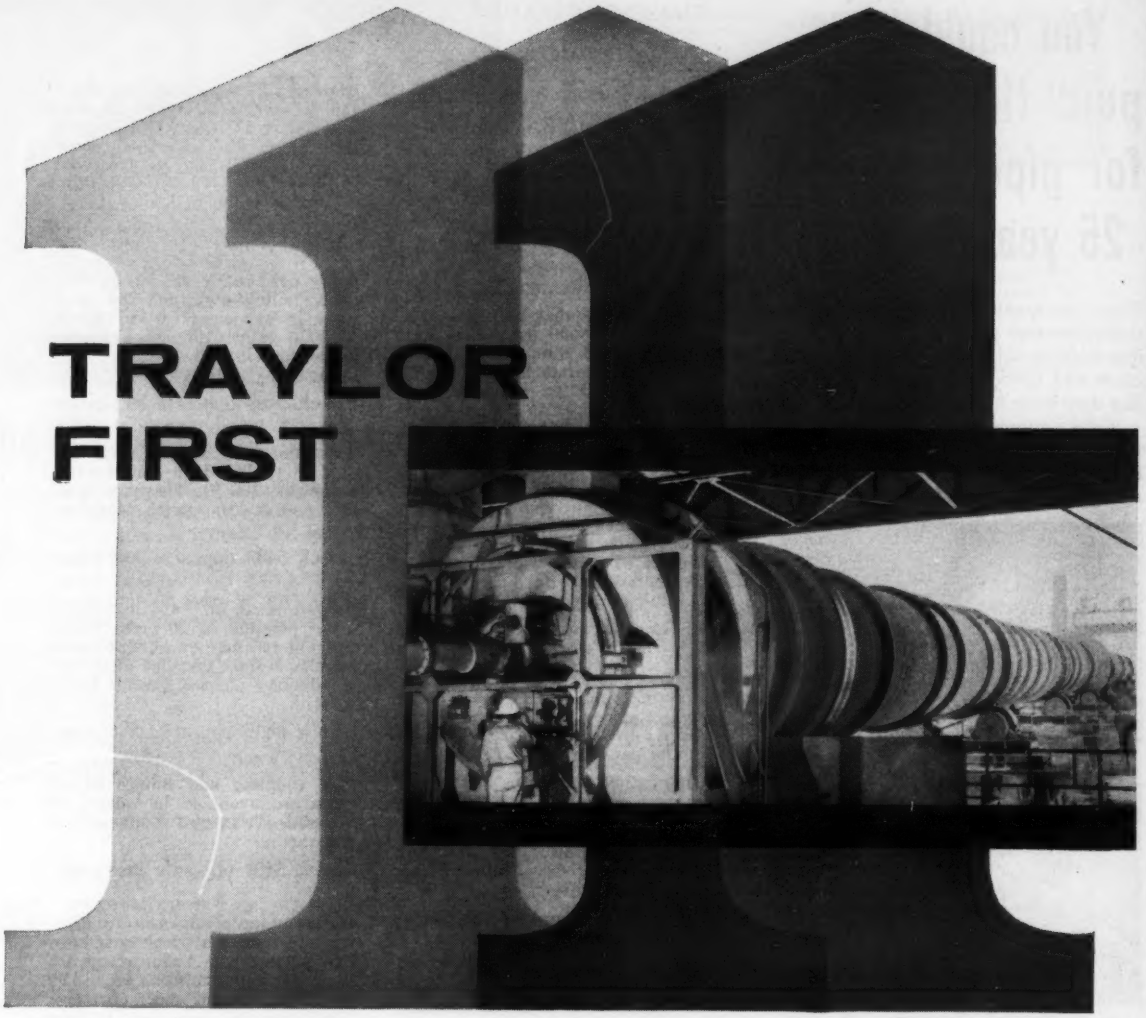
Slide valves for gases, slurries or free-flowing solids of three types are considered in three bulletins. Standard model, quick-cleaning version which need not be removed from line for cleaning, and heavy duty style for line pressures to 60 psi are taken up in Buls 500R, 501R and 508, respectively —W. S. Rockwell Co.

Check 5477 opposite last page.

Plug-valve-lubrication system minimizes corrosion. Illustrations and applications of various plants of these valves are presented in Cat 400—WKM, Division of ACF Industries.

Check 5478 opposite last page.

"Mr. Reddinck, you must get awfully tired of looking at figures all day."



Why this 1933 first welded kiln could be the key to your company's profits in the 60's

For the simple well-proved reason that they're better, kilns of all-welded construction are pretty much "standard" today. Important to keep in mind: the standard was set by Traylor . . . builder of the first welded kiln in 1933.

A radical innovation a generation ago —but why so important now? First and obviously, it means that Traylor has the longest record of experience in this special kind of equipment.

More important still: It's merely one example of Traylor's coming up first with new ideas to meet changing needs. Benefits of other Traylor "firsts"— some dating before 1933, many since— are being reaped today throughout the industry, quite likely already including your own plant. Traylor built, for example, the first 60-inch primary gyratory crusher and the first large ball mill.

Today Traylor's proved capacity to pioneer sound innovations in kilns, mills and crushers is enhanced by expanded research capabilities and process know-how.

Up-to-date facilities and a long, impressive record of past "firsts" are a good combination of reasons to call on Traylor first when you're planning for efficient operation in the changing business climate of the sixties.

See Chemical Engineering Catalog for details and specifications.

Traylor

TRAYLOR ENGINEERING & MANUFACTURING

DIVISION OF FULLER COMPANY

1552 MILL STREET • ALLENTOWN 1, PA.

4452 TKA-15

Check 5479 opposite last page.

You could have paid the last bill for pipe corrosion 25 years ago . . .

There are many PYREX® glass pipe installations that old and older—corrosive installations—which are still as smooth, clean and serviceable as they were the day they were first put to work.

Take a moment to estimate roughly what pipe corrosion costs *you*. With PYREX glass pipe, the difference can be as lopsided as 100%. Here's why:

PYREX pipe is resistant to more acids and acidic materials than any other pipe. It delivers even the most active of acids without a trace of corrosion.

Problems of side reaction, pickup, and contamination are practically nonexistent—even at temperatures up to 450°F.

How much could you save in the *next* 25 years if you never had to replace a corroded pipe?

Bulletin PE-3 has all the facts. It's yours for the asking.

CORNING GLASS WORKS
2908 Crystal Street, Corning, New York
CORNING MEANS RESEARCH IN GLASS

Please send me Bulletin PE-3, PYREX Brand "Double-Tough" Glass Pipe and Fittings.

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Title.....
Company.....
Address.....
City.....Zone.....State.....

Check 5480 opposite last page.

CURRENT LITERATURE

Ball-valve double-blocking, bleeding and flushing in cryogenic service is detailed in Ball Valve Cat—The Cameron Iron Works, Incorporated.

Check 5481 opposite last page.

Pumps

Canned-pumps may be used under pressures to 5000 psi, have capacities to 1000 gpm, heads of 625 TDH, and operate in temperature range of −300 to +1000°F. Full story is contained in Bul 1070-2—Chempump Division, Fostoria Corporation.

Check 5482 opposite last page.

Flexible-tube pump which, impels fluids at 185 gph without contact of metal with effluent, is considered in Bul C-612—The Randolph Co.

Check 5483 opposite last page.

Rotary pumps are available in sizes of ½ to 1050 gpm in over 850 cataloged models. Line is indexed in Cat 61-SCC—Viking Pump Company.

Check 5484 opposite last page.

Vertical and horizontal pumps are specified in Buls V837 and Bul C-355, respectively—Taber Pump Co.

Check 5485 opposite last page.

Fluids Handling

Packing and gasket materials are specified in Cat P-100—Packing Division, Raybestos-Manhattan, Inc.

Check 5486 opposite last page.

Braided Teflon packings are available in several types and all sizes in standard 1/16" increments from ⅛ to ¾" square—in spool or coil forms. They are featured in Bul CP-552—Chemical & Power Products, Inc.

Check 5487 opposite last page.

Spray nozzles are available in full-cone, hollow-cone and flat-spray types in capacities of ⅛ pt/min to 4000 gpm. Complete line subject of Spraco Nozzles Cat—Spray Engineering.

Check 5488 opposite last page.

Ball joints are available in sizes of 2 to 16" for high temperatures —(500 to 1200°F). They are specified in Cat 250—Barco Manufacturing Co.

Check 5489 opposite last page.

Positive seals, at −452 to 3000°F under pressure of 10^{-6} mm Hg to 100,000 psi, may be obtained with metallic O-rings specified in O-Ring Handbook—United Aircraft Products Inc.

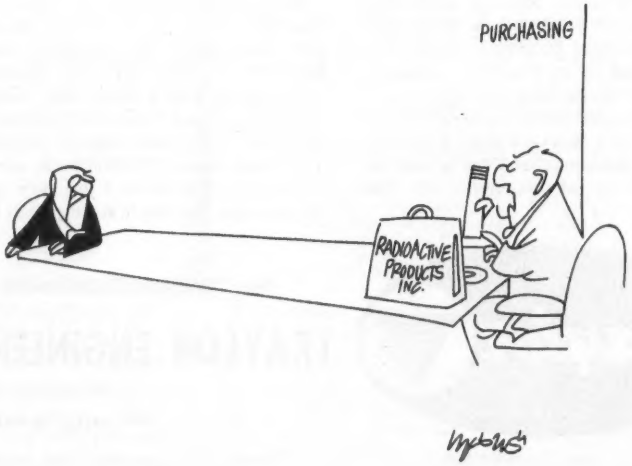
Check 5490 opposite last page.

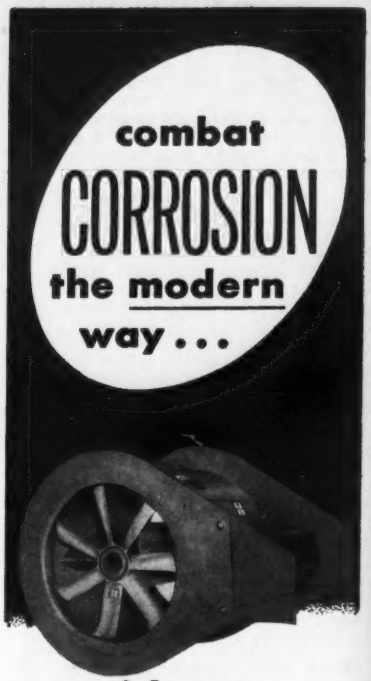
Pipe coupling and fittings of all types are available in variety of materials—Victaulic Company of America.

Check 5491 opposite last page.

Gasket materials made from TFE-fluorocarbon felts which have been impregnated with Teflon resins are designed for application of −100 to ±400°F range under corrosive conditions. A four-page bulletin gives properties, potential uses and case histories. Armalon Gasketing Bul—Fabrics Division, E.I. du Pont de Nemours & Co., Inc.

Check 5492 opposite last page.





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FIBER GLASS
DUCT FANS

Featuring a unique built-in orifice and tear-drop shaped belt housing, Aerovent *Fiber Glass* Duct Fans are designed for your "*problem*" ventilating requirements. Virtually unaffected by normal concentrations of corrosion and most forms of chemical attack, *fiber glass* – used in the construction of the fan housing and other internal surfaces– assures longer, more dependable service in even the most difficult applications.

Propellers are stainless steel or Dura–a special alloy created by Aerovent for better resistance to corrosive atmospheres. Available in 17 models in sizes 14" to 42" for capacities to 32,500 cfm.

write for bulletin 175

Aerovent *Aerovent*
FAN COMPANY, INC.
Ash and Burr Streets Piqua, Ohio

Check 5493 opposite last page.

CURRENT LITERATURE

Titanium heat-exchanger in salt-water service tube has calculated corrosion rate in commercially pure state of 0.001" in 1250 years in salt-water service. Wolverine Tube, Division of Calumet & Hecla, Inc.

Check 5494 opposite last page.

Steam-trap sizing, installation and maintenance . . . for any pressure, temperature or load . . . in addition to specification data are all included in 48-page Cat K—Armstrong Machine Works.

Check 5495 opposite last page.

Spray nozzles are available in over 14,000 types and sizes. They are indexed in 48-page Cat 24—Spraying Systems Co.

Check 5496 opposite last page.

Gaskets are produced either in sheet form or cut to specifications. Among many types offered, are those with synthetic binder and long-fibre asbestos for hot-oil service at 700°F. Garlock Inc.

Check 5497 opposite last page.

Pump Cups are available in both conventional and 45°-bevel types. Further facts are outlined in Bul 5903—Darling Valve & Mfg. Co.

Check 5498 opposite last page.

Forged-steel valves, fittings, flanges and unions are shown in their application to specific types of pipe products in 432-page Cat F-10—Henry Vogt Machine Co.

Check 5499 opposite last page.

Steam-trap case history outlines how Monarch Wine Company succeeded in maintaining 140° temperature in their heat exchangers despite wide variations in rate of line flow (5 to 60 gpm). Case History 185—Sarco Company, Inc.

Check 5500 opposite last page.

Material Handling and Packaging

Bin vibrators are available in air or electric, portable or permanent, silent or standard types. Literature on these is published by Cleveland Vibrator Co.

Check 5501 opposite last page.

Drums and barrels of stainless steel, Monel and nickel are depicted in four-page Drums and Barrels Bul—Pressed Steel Tank Company.

Check 5502 opposite last page.

Bag palletizers are automatic operatorless unit. They are covered in Automatic Palletizers Bul—Miller Engineering Corporation.

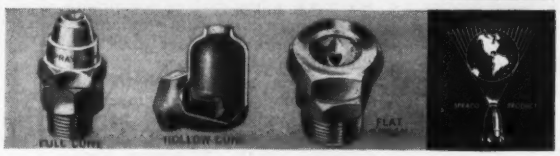
Check 5503 opposite last page.

Wide choice...and fast service!

Spraco has the most complete line of nozzles available anywhere — **and all from stock.** Full cone — hollow cone — flat spray. Bronze, cast iron, or stainless. Capacities from ⅛ pint/min. to 4,000 gal./min.

Spray's new nozzle catalog is more than a catalog — it's a reference book. Write today for your free copy.

SPRAY ENGINEERING 105 Cambridge Street, Burlington, Mass.



Check 5504 opposite last page.

Babbitt *Adjustable* **SPROCKET RIM** *with Chain Guide*

CHANGES THAT DANGER ZONE TO A SAFETY ZONE

— enables you to ADD PLANT AREA

If re-aligning equipment will yield more working space, better production, lower costs —do it NOW. Save all space wasted for placing ladders to reach overhead valves. At the same time, convert Danger Zones to Safety Zones. Equip every overhead valve wheel in your plant with Babbitt Adjustable Sprocket Rims with Chain Guides.

- They simplify pipe layout.
- They fit any size valve wheel.
- They are easy to install and operate.
- They operate any valve from the floor.
- They save time and money.
- The first cost is the only cost (no maintenance).
- They are packed completely assembled (one to a carton), with easy-to-follow instructions.
- A hot-galvanized rust proof chain is available for all sizes.

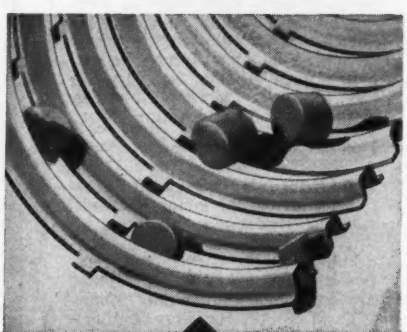
Babbitt Adjustable Sprocket Rims with Chain Guide are carried in stock by most mill supply houses. Just phone your mill supply salesman, or contact us direct.

Babbitt STEAM SPECIALTY CO.

14 BABBITT SQUARE, NEW BEDFORD, MASS., U.S.A.

Check 5505 opposite last page.

get accurate sizing with SIMON-CARTER machines

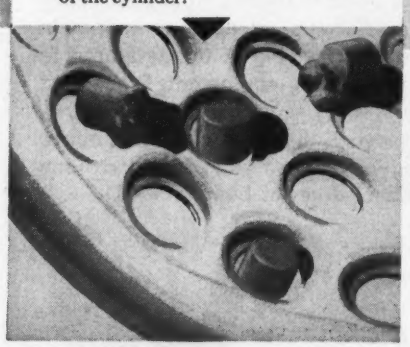


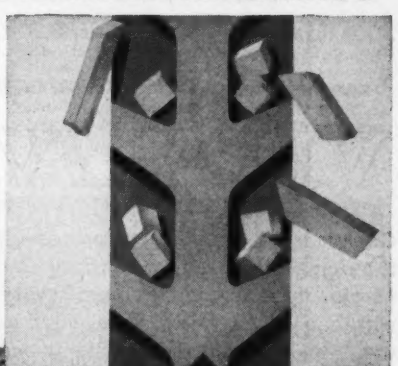
PRECISION GRADERS SEPARATE MATERIAL BY THICKNESS

For sizing and separating free-flowing granular materials by *thickness,* Carter Precision Graders use revolving cylinders with slotted perforations. Material placed in these cylinders is upedged and presented to the slots in an edgewise position. The thinner pieces pass through, and the thicker pieces pass over and are conveyed to the end of the machine.

CARTER GRADERS ALSO SIZE AND SEPARATE BY WIDTH

For *width* sizing and separating, the Precision Graders use revolving cylinders with round perforations. Material placed in these cylinders is upended and presented to the round perforations in an endwise position. Narrow pieces pass through, and wider pieces pass over for discharge at the end of the cylinder.





CARTER SEPARATORS ASSURE POSITIVE LENGTH SEPARATION

Carter Disc Separators contain a series of discs, each of which has hundreds of undercut pockets which select or reject materials according to *length.* As the discs revolve through a mixture of materials, the pockets lift out shorter pieces. Longer pieces, too long to be held in the pockets as they rise, drop away from the discs.

Write today for complete information and descriptive booklets on Simon-Carter machines. Free laboratory testing and demonstrating service.

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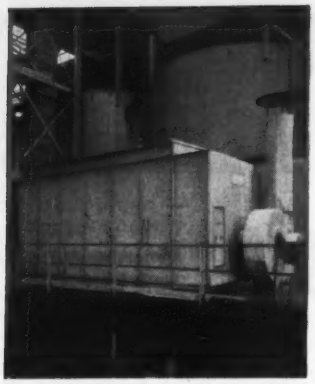
Check 5506 opposite last page.



Four tons of valuable dust are recovered daily by this Dustube Collector, ventilating the processing of sintered phosphate ores in a prominent chemical plant.

Dustube® collectors beat the heat in fume control

A demonstration of WHEELABRATOR'S

VITAL VALUES

Chemical and metallurgical process gases, with temperatures far beyond the range of conventional synthetic fabrics, are no problem to Wheelabrator dust and fume control systems. Dustube collectors equipped with special filtering fabrics, such as silicone-treated fiberglass, have the Vital Capacity to withstand acids, alkalis, or abrasive materials encountered in specific applications, and filtering at temperatures to 550°F, eliminate the need for costly pre-cooling equipment. Since dust is collected in the dry state and removed by repressuring or shaking, recovery of valuable materials is facilitated. Collection efficiencies above 99% are normal. For engineering consultation on your dust and fume control problems, call on Wheelabrator. Write for bulletin 562-D.

VITAL VALUES FOR INDUSTRY

WHEELABRATOR DUST AND FUME CONTROL

WHEELABRATOR CORPORATION, 478 S. Byrkit St., Mishawaka, Ind.
In Canada, WHEELABRATOR CORP. of Canada, Ltd. P.O. Box 490, Scarborough, Ont.

Check 5507 opposite last page.

CURRENT LITERATURE

Fluid and gas pressure tanks, which are Government-surplus items are depicted in Tanks Cat—Groban Supply Company.

Check 5508 opposite last page.

Vibration inducers which move materials out of hoppers down chutes and through screens are depicted in 42-page Vibrolator Cat—The Martin Engineering Company.

Check 5509 opposite last page.

Complete printed weight records are provided by special unit on full 8½ x 11 forms, or on tickets or strips. Positive weight identification, with selective numbering, weight symbols, or consecutive numbering, is available. Further details are contained in Bul 2017—Toledo Scale, Division of Toledo Scale Corporation.

Check 5510 opposite last page.

Storage and reclamation machines, for stock piling and/or reclaiming bulk materials from buildings, bins and ground-storage piles, can deliver directly to one or more hoppers at ground level, to conveyors and processing machines or up ramp to elevated hopper. They are presented in 26-page General Cat E—Sauerman Bros., Inc.

Check 5511 opposite last page.

Bulk-handling railroad car is designed to protect plastic resins from contamination and moisture pickup. Built with three separate compartments, each with its own nozzles and hatches, car incorporates special nozzles for pneumatic unloading. Details may be obtained from Airslide and Dry-Flo Car Division, General American Transportation Corporation.

Check 5512 opposite last page.

Tractor-shovels incorporate dual-filtering of engine intake and individual cartridge-type filters on all three oil systems—for engine, hydraulics and torque-converter/power-shift transmission. These are considered in booklet, "Industrial Materials Handling From A to Z"—The Frank G. Hough Co., Subsidiary of International Harvester Company.

Check 5513 opposite last page.

Fork-lift truck of 3000-lb capacity is powered by engine developing 35 bhp at 2400 rpm. It is further expanded upon in four-page Bul BU-600A—Engine-Material Handling Division, Allis-Chalmers.

Check 5514 opposite last page.

For more information on developments reported in this section, check corresponding numbers on Reader Service Slip opposite last page of this issue.

You know you're RIGHT with **JERGUSON LIQUID LEVEL GAGES**

★ clear visibility
★ easy installation
★ long life
★ minimum maintenance

Complete line — wide range of sizes, pressures, hook-ups, materials.

Reflex or Transparent — *Reflex* for pressures up to 4000 lbs. @ 100° F. *Transparent* for pressures up to 20,000 psi test.

Design-construction — liquid chamber machined from solid steel bar. Covers and glasses tightly locked over liquid chamber. Perfect seating, confined gasket insures against failure. Glasses practically unbreakable; specially treated for clear visibility over long periods. Metal parts rustproofed.

Choice of Materials — stainless, monel, nickel, hastelloy, etc. Rubber, neoprene, lead, teflon, Kel-F and other linings. Meet or exceed AISI, ASTM and/or API-ASME requirements.

Specials — include non-frosting, large chamber, heated, welding pad, remote reading, lined, inclined and magnetic.

Every gage backed by over 50 years of experience . . . your guarantee of complete satisfaction.

Want details? Write for Catalog No. 316.

JERGUSON
Gages and Valves for the Observation of Liquids and Levels
JERGUSON GAGE & VALVE COMPANY
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Offices in Major Cities

see exhibited at ISA SHOW, booth 903

Check 5515 opposite last page.

ROSKOTE

NEW - EASY TO APPLY PIPE MASTIC ROSKOTE

COLD APPLIED PIPE MASTIC

ROSKOTE

Provides extremely fast drying time

Least objectional fumes and skin irritants

Cold application to irregular surfaces . . valves, regulators . . casings . . etc.

Resists moisture, weathering, acids, alkalies and electrolysis

Withstand severe vibration, bends and distortion.

No expensive machinery or labor needed to apply

Write for Bul. CP7 to
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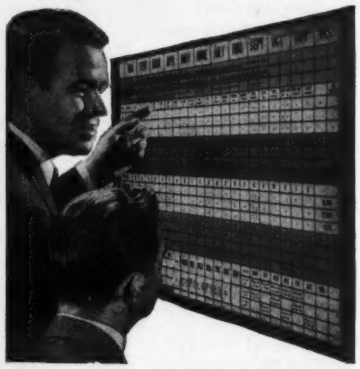
ROYSTON LABORATORIES, INC.

Check 5516 opposite last page.

You Get Things Done With Boardmaster Visual Control



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GRAPHIC SYSTEMS
Yanceyville, North Carolina

Check 5517 opposite last page.

CURRENT LITERATURE

Trackmobiles, which move rail cars in and around plants, each have auxiliary set of road wheels. These can be hydraulically lowered so that Trackmobile can run across tracks to any out-of-the-way spot. It is discussed in booklet, "Tricky the Trackmobile"—Whiting Corporation.

Check 5518 opposite last page.

Conveying

In conveyor-elevators, material movement is continuous within totally enclosed dust-tight casings. Additional details are reviewed in Bul 358—Engineering Division, Stephens-Adamson Mfg. Co.

Check 5519 opposite last page.

Packaged pneumatic-conveying systems can handle 75 to 80% of air-conveying requirements by use of one of four standardized units. Specifications on standardized components, capacities and hp requirements are contained in Bul 228—Sprout, Waldron & Co., Inc.

Check 5520 opposite last page.

Bulk-handling systems are reviewed in facts available from Fluidizer Division, Daffin Corporation.

Check 5521 opposite last page.

Plant Engineering & Safety

Hydraulic oil filters and oil reclaimers are considered in bulletins put out by The Hilliard Corp.

Check 5522 opposite last page.

Wire cloth, which is available in unusual metals or alloys as well as in standard types, is tabulated in 120-page Wire Cloth Cat—The Cambridge Wire Cloth Co.

Check 5523 opposite last page.

Explosion-proof receptacle and matching plug incorporates pressure-types solderless receptacle connectors. Complete information is contained in Bul CES 660—Appleton Electric Company.

Check 5524 opposite last page.

Centrifugal compressors are inspected by manufacturer in nondestructive testing laboratory using cobalt 60, iridium 192 or 160-kv X-ray equipment. Ingersoll-Rand.

Check 5525 opposite last page.

In decontamination booth, victims walk on foot treadle and are instantly bathed in water from a dozen nozzles. An eye wash is simultaneously activated. For further information see Decontamination Booth Details—Haws Drinking Faucet Co.

Check 5526 opposite last page.

Above: A typical Taylor-Stiles "GIANT" Dicing Cutter in use at the Baldwin Rubber Company, Pontiac, Michigan.

WHAT IS TAYLOR-STILES?

Taylor-Stiles & Company is an organization specializing in industrial cutting equipment for rubber, plastics and other industries. This equipment has been marketed throughout the world for approximately one hundred years under the registered trademark "GIANT". While most of the machines are constructed to basic designs and operating principles, each machine is built for a specific purpose and in accordance with the customer's specifications and requirements. "GIANT" Cutters and Shredders are essentially mechanical shears. The fly knives on the revolving cylinder or cutterhead shear on an angle against one or more fixed bed knives. The action is much the same as that of the blades of a pair of scissors engaging each other to give a shearing effect. The cutterhead is a heavy steel forging which "stores" or accumulates a considerable amount of force or momentum. When this tremendous momentum is put behind the shear cutting knives, with the single point of contact with the stock being cut, maximum cutting action is obtained with the least amount of horsepower required. You get low upkeep, long knife life, clean cutting and smooth, minimum-vibration operation. Taylor-Stiles has recently enlarged and improved its facilities and installed many new high production machines. This continuing plant modernization program enables us to give you the best possible service in designing, testing and building the famous "GIANT" Cutting Machines. Write today for the latest bulletin on Rubber Cutting and your copy of "What IS TAYLOR-STILES"?

TESTING ROOM

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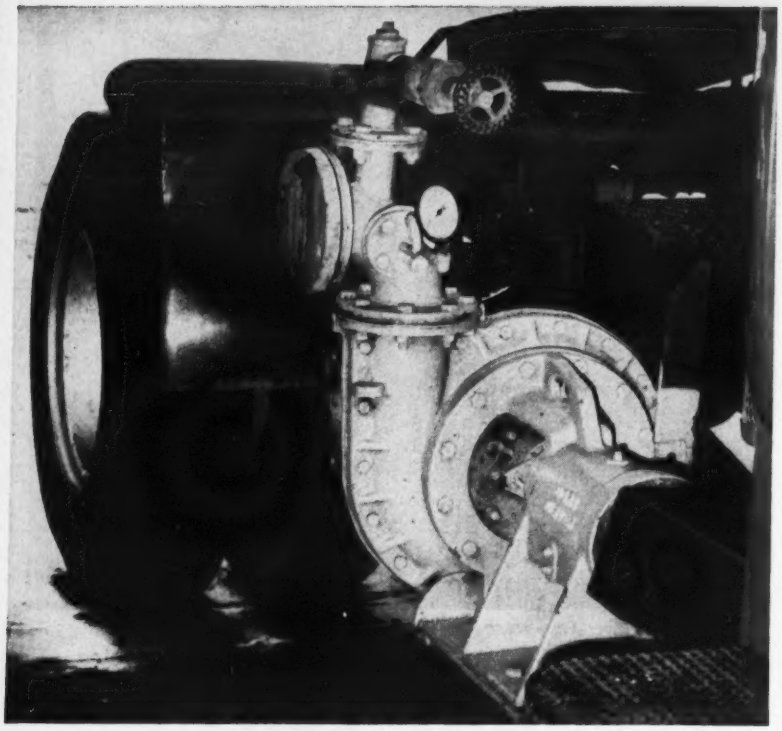

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A specialized service involving the removal of scale deposits from boilers, heat exchangers and process equipment in the utility, chemical, petroleum and other industrial plants is offered by Sumco Engineering, Inc., Passaic Avenue, Caldwell Township, New Jersey.

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Hypalon—Reg. T.M. E. I. duPont de Nemours & Co.

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Check 5528 opposite last page.

CURRENT LITERATURE

Ratchet threader uses one set of dyes to thread 1, 1½, 1¼ and 2" pipe and conduit. Ratchet Threaders—The Ridge Tool Company.

Check 5529 opposite last page.

Ringless piston compressors of non-lubricated type are pictured and described in six-page Compressors Bul—Sulzer Bros. Inc.

Check 5530 opposite last page.

Trichlorethylene metal-finishing systems are considered in four-page bulletin discussing 1) integrated vapor degreasing and non-flammable painting; 2) vapor degreasing and dry phosphatizing; and 3) vapor degreasing, dry phosphatizing and non-flammable painting. Triclene Finishing Bul—Chlorine Products Division, Electrochemicals Department, E.I. du Pont de Nemours & Co., Inc.

Check 5531 opposite last page.

Insulation tape is pliable, cork-filled and self-adhering. Insulation plastic coating can be used on metal, concrete, brick, plaster and tile. They are both featured in Technical Handbook—Mortell Company.

Check 5532 opposite last page.

Fluorocarbons and fluorocarbon products are pictured and specified in 16-page Fluorocarbons Bul—Enflo Corporation.

Check 5533 opposite last page.

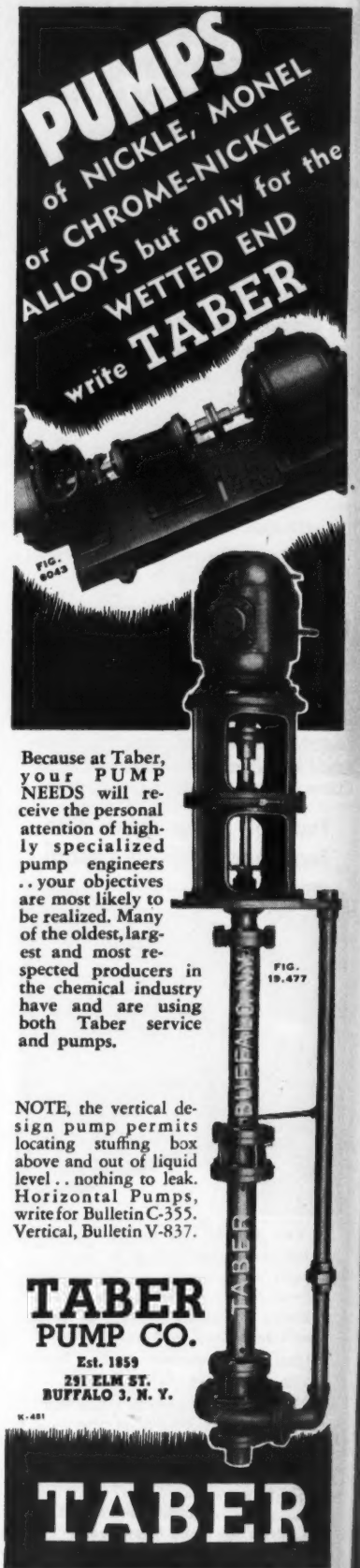
Visible-blade switches incorporate handle which is integral part of switch, not cover. When door is open, handle remains attached to switch. Visible Blade Switches—Square D Company.

Check 5534 opposite last page.

Air conditioners control temperatures to fraction of degree and relative humidity to with ±1%. They are delineated in Buls 58 and 122—Niagara Blower Co.

Check 5535 opposite last page.

"Peanut butter and jelly, salmon salad, cheese, egg salad. My, my, Friday certainly rolls around fast."



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CURRENT LITERATURE

Centrifugal-compressor line includes single-stage units for pressures to 1000 psi in capacities to 700,000 cfm, multi-stage horizontally split versions for pressures to 800 psi in capacities to 200,000 cfm, multi-stage vertically split models for pressures to 5500 psi in capacities to 20,000 cfm, and intercooled 100-psi units. Ingersoll-Rand.

Check 5538 opposite last page.

Rotary positive blowers incorporate three-lobe design. Capacities of 30 production models are in range of 30 to 4000 cfm for pressures to 15 psig, (single), 70 psig-(multi-stage). Three-lobe Blowers Information may be obtained from M-D Blowers, Inc., Subsidiary of Miehle-Goss-Dexter, Inc.

Check 5539 opposite last page.

Multi-louvered dampers are taken taken up in Bul DA-16—The Fly Ash Arrestor Corp.

Check 5540 opposite last page.

Wire cloth and screen are considered in Cat 105—Ludlow-Saylor Wire Cloth Company.

Check 5541 opposite last page.

Wire-cloth line includes over 50,000 specifications in different types, sizes, metals, meshes and designs. The W. S. Taylor Co.

Check 5542 opposite last page.

Comparison of heat-transfer cement to steam tracing and steam jacketing is reviewed, along with description of simple application method on both steam tracing and electrical-resistance system, in Bul 300—Thermon Mfg. Co.

Check 5543 opposite last page.

Waste-disposal systems are considered in information put out by Thermal Research & Engineering.

Check 5544 opposite last page.

Blowers are designed to operate applications to 2000°F without duct work. Plug-in-type units are specified in Bul 960—Garden City Fan & Blower Co.

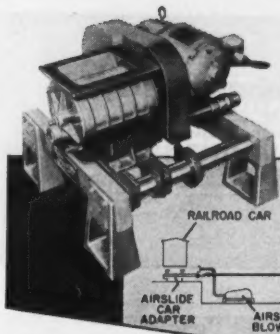
Check 5545 opposite last page.

Self-curing sacrificial metal primer offers resistance with or without top coat, to organic and inorganic solvents, fresh or salt water, and oils and greases. It consists of modified lacquer base to which is blended metal zinc powder to form blended solution of better-than-57% total solids by weight. Technical data is available from U.S. Stoneware.

Check 5546 opposite last page.

Portable ventilators are subject of Vano Ventilators Facts—Coppus Engineering Corp.

Check 5547 opposite last page.



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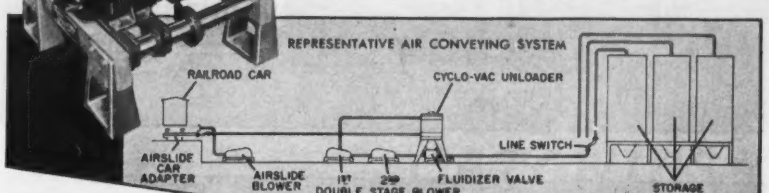

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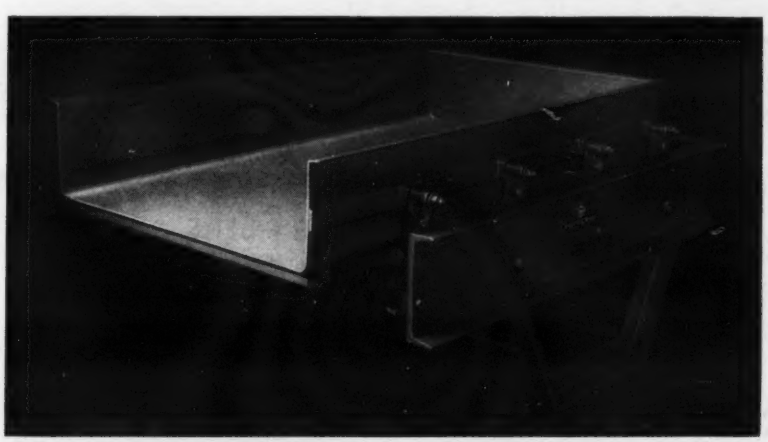

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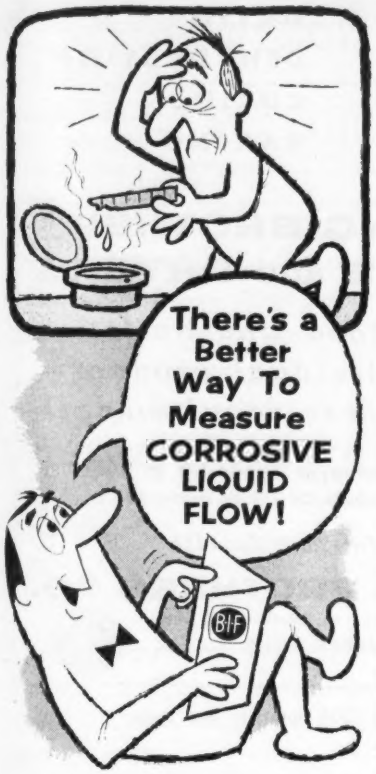

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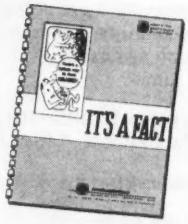

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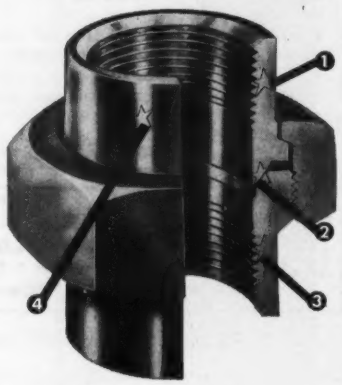

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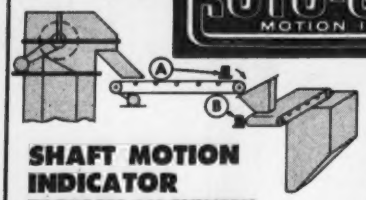

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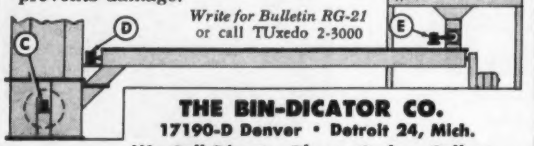

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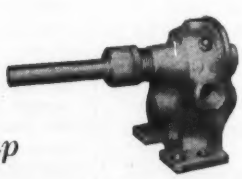

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Since 1899 . . . Noted for Highest Quality Gear Pumps

Check 5553 opposite last page.

that's interesting

Thermoelectric generator is lantern-powered

A pint of kerosene or fuel oil burned in unit, not unlike the old kerosene lantern, provides enough heat to operate continuously for 24 hr a portable thermoelectric generator capable of powering a transistor radio.

The Axtec generator by replacing batteries for operating transistor radios, provides a power source that can be stored for long periods of time. It provides full power less than minute after wick has been lighted.

Heat from flame acts on six hermetically sealed thermocouples to produce low voltage, high current electrical power. Generator develops

Kerosene flame provides heat source for generator to develop power necessary to operate radio

approximately 0.75v and delivers ½w. Built-in transistorized converter changes 0.75v output to 3 to 9v required to operate most battery-powered transistor radios. Generator was developed by Minnesota Mining & Manufacturing Co.

Choosing best antiknock compound complex job

With a choice among nine or more antiknock compounds, any one of which, singly or in combination, may best take advantage of his gasoline

for uniform results
in . . . **DRYING**
DEHYDRATING
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Spray, brush or roll Adheron on wood, steel or masonry surfaces for a tough, flexible, chemical and acid resistant coating.

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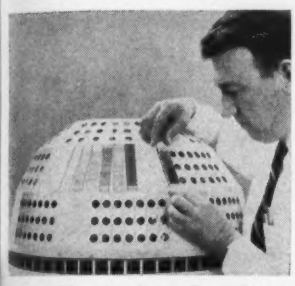
blending stocks, a refiner has a complex problem on his hands.

Add to this the greater variety of cars with corresponding variety of requirements, and the refiner's problems multiply.

Sapphire-shielded satellite to last 10 yr in space

Solar cells on a communications satellite, now being developed by Bell Telephone Laboratories, will be shielded from space radiation by thou-



Assembly of solar cells with a transparent covering of man-made sapphires is being set in place on communications satellite

sands of pieces of man-made sapphires.

This protection is expected to enable "working" telephone satellites to endure the rigors of space for 10 years or more.

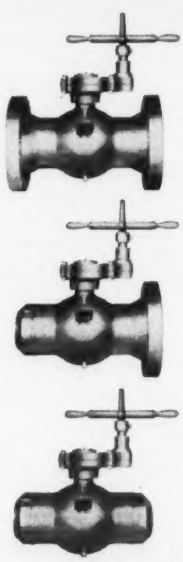
Two satellites are under development—one with 27" diam, the other 4' diam. Smaller one would be covered by over 4000 solar cells; the larger, by 12,000. Each cell will be shielded by a slice of sapphire.

Rocket booster possible to lift 3500-ton craft

Within 30 months giant solid rocket booster, capable of pushing 3500-ton vehicle into space, could be ready, Dan A. Kimball, president of Aerojet-General Corporation, declares.

Giant booster, possible with presently available techniques, would generate 17 million lb of thrust for minute. Booster would serve as first stage on four-stage vehicles.

"WE STANDARDIZED ON CAMERON BALL VALVES"



"The Cameron Ball Valve was approved by our engineers for its compact design, rotating seats to distribute wear, lack of bonnets or glands and its sealed-for-life construction. The operating men like its ease of installation, low-friction operation, lack of lubrication and lack of maintenance. Management appreciates not having to stock repair parts, the lack of down time, and the prompt delivery in a wide range of sizes and pressures . . . and the outstanding performance on our test installations really sold us." Have you carefully considered the many features Cameron Ball Valves offer?

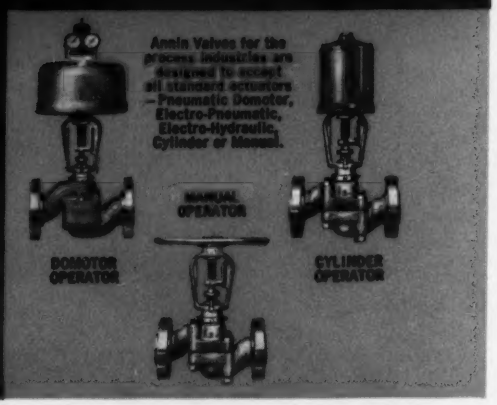
CAMERON IRON WORKS, INC.
P. O. BOX 1212 HOUSTON, TEXAS

CAMERON BALL VALVES

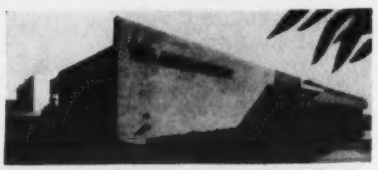
Check 5556 opposite last page.

WHY ANNIN IS THE CHEMICAL INDUSTRY'S LEADING PRODUCER OF ALLOY CONTROL VALVES

...OVER $1½ MILLION IN ALLOY VALVE BODY PARTS CARRIED IN STOCK


Annin Valves for the process industries are designed to accept all standard actuators —Pneumatic Domotor, Electro-Pneumatic, Electro-Hydraulic, Cylinder or Manual.
MANUAL OPERATOR
DOMOTOR OPERATOR
CYLINDER OPERATOR

In specifying control valves, the Chemical Industry says make them *strong*, make them *light*, make them *versatile*, and by meeting these standards Annin has become the leading supplier of alloy valves for process control. The above photo, showing a portion of Annin's $1½ million inventory of alloy body parts, is in itself only part of the story. Annin's split body construction... easily replaceable trim... the flexibility of angle, or 3-way bodies immediately supplied from stock... the reduction in overall weight without sacrifice of strength... are other factors in Annin leadership. You can benefit by the inventory economy, ease of maintenance, and basic design advantages of Annin Valves... recognized by control engineers and valve designers as the outstanding valve development of the past twenty-five years for the control of hot, cold, erosive, corrosive, or viscous fluids. *Write today for General Catalog 1500-E.*



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